Power Engineering

MAY, 1953

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TECHNICAL PUBLISHING COMPANY CHICAGO, ILLINOIS

Assembly line in Elliott Company welding shop.

THE LATEST DESIGN *of Elliott deaerating heater incorporates this stainless steel vent collecting hood, which with the inlet spray assembly is located inside the shell at the top. This replaces the former tubular vent condenser located outside the shell in older designs, requires no maintenance beyond occasional inspection, and simplifies headroom problems.*

At right, a 975,000-lb-per-hr Elliott vertical deaerating feedwater heater, mounted on its storage tank, set up for final testing in the Elliott shops. A notable feature is that stainless steel is used throughout wherever there is contact with corrosive water. This includes the trays which are of fabricated stainless steel and light in weight.

deaerating heaters
ELLIOTT
does the whole job!

Users of Elliott deaerating heaters enjoy the assurance that the entire construction of each unit is Elliott shop-built all the way through. No responsibility for any part of the construction is delegated to an outside organization. Elliott quality is rigidly maintained right from the bending of the first plate to the welding of the last inch of joint. The entire unit is set up, hydrostatically tested, dismantled, and loaded on flatcars for shipment. At no time has the heater or any part of it, been outside the Elliott plant.

For full details on Elliott deaerating heaters, contact your local Elliott representative or write Elliott Company, Jeannette, Pa.

ELLIOTT Company

N3-1

DEAERATOR AND HEATER DEPARTMENT

For more data circle 501 on Post Card

NO GETTING AROUND IT!

Half-Way Protection Is Not Good Enough!

De Laval Oil Purifiers continuously remove and discharge water while removing the dirt as well. And water is the real trouble maker as often as not. In turbine lubricating systems, for instance, condensate water in the oil leads to the formation of sludge, and sludge, of course, is well recognized as the source of trouble in turbine lubrication systems.

Diesel oils, too, should be kept dry if the formation of emulsions is to be avoided. Purification by centrifugal force is of more than ordinary importance with the heavier types of diesel lubricating oil.

Centrifugal force applied in the De Laval bowl gives equally positive protection against dirt . . . keeps the oil clean and in "like-new" condition.

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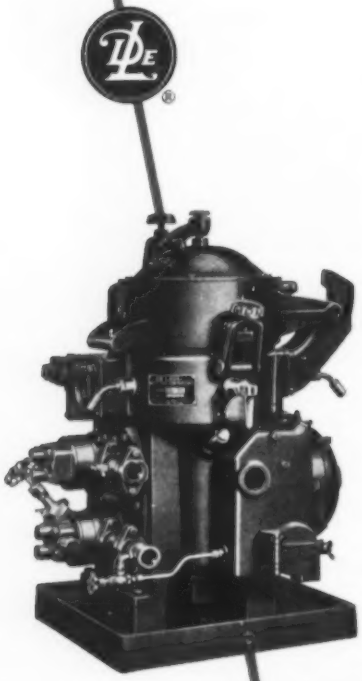

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Chicago POUGHKEEPSIE, N.Y. San Francisco

DE LAVAL

for more dependable power production

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MAY 1953
VOL. 57 • NO. 5

Low-pressure spindle for one of two 120,000-kw cross-compound reheat steam turbines for WEP Co.'s new Oak Creek Station

Power Engineering

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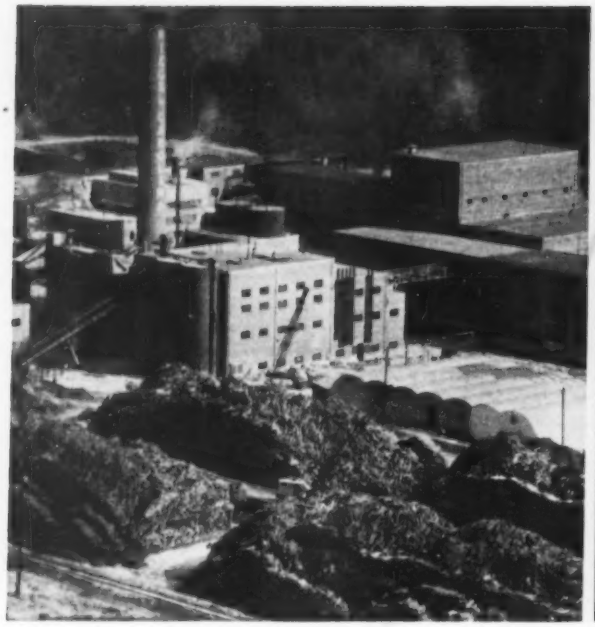
The only magazine devoted exclusively to the job interests of power engineers

Oh, I see



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OIC iron valves, steel valves, bronze valves—you see hundreds of them all through this amazing new plant of the Riegel Carolina Corporation near Acme, North Carolina. The OIC Long Line of Valves—proved dependable in years of similar service—enabled Piping Equipment Company of Greensboro, North Carolina, to meet every kind of flow problem in this pulp mill.

THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

OIC FOUNDED 1881

VALVES . . . FORGED & CAST STEEL, IRON & BRONZE

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ENGINEERS' PREVIEW

COMMISSIONER MICHAEL W. STRAUS of the Bureau of Reclamation has announced that he was accepting "with reluctance" the request for retirement of H. A. Parker, District Manager for the 1,029,000 acre Columbia Basin Project in central Washington. The Commissioner announced simultaneously the appointment of P. R. Nalder, Assistant District Manager, to the top post.

Mr. Parker is a veteran employee of more than 42 years service with the Bureau of Reclamation. Mr. Nalder is the second oldest employee in length of service on the Columbia Basin Project, arriving before the formal ground breaking for Grand Coulee Dam in 1933.

★ ★ ★

DETROIT EDISON COMPANY engineers — Executive Vice-President Paul W. Thompson, Chief Civil Engineer John R. James, and Staff Engineer William B. Hurley are now retired. These men are well known in their field and have authored numerous articles for technical publications. Mr. James has written a number of articles on construction subjects and has made a special study of the use of fly-ash as a building material.

★ ★ ★

NEW YORK, NEW HAVEN AND HARTFORD RAILROAD has ordered ten all-electric locomotives, a rectifier type of motive power, from the Locomotive and Car Equipment Department of the General Electric Company. This will be the largest application of this type of locomotive in this country.

The electric equipment on this locomotive converts a-c from the overhead wire into d-c for driving the traction motors on the locomotive axles. Rectifier tubes are the heart of this conversion system.

With a continuous rating of 4000 hp at the rails, the locomotives will be capable of operating up to 90 mph with a train of cars.

★ ★ ★

NATIONAL ELECTRONICS CONFERENCE INC., 1953, will be held September 28, 29 and 30, 1953 at the Hotel Sherman in Chicago. Dr. J. D. Ryder, head of the electrical engineering department, University of Illinois, Urbana, has been named president. Dr. C. E. Barthel, Jr., Illinois Institute of Technology, Chicago, has been named chairman of the board. Additional information can be obtained from S. R. Collis, Chairman, N.E.C. Publicity Committee, Illinois Bell Telephone Co., 208 W. Washington St., Chicago 6, Illinois.

★ ★ ★

APPOINTMENT of Arthur F. Erwin and Edward F. Brill as manager and chief engineer, respectively, of Allis-Chalmers atomic power section has been announced by J. F. Roberts, vice president and director of engineering of the company's general machinery division.

Allis-Chalmers' atomic power section was organized early in 1949 to undertake the development and manufacture of nuclear reactor structures and components, to participate in atomic power projects, and to coordinate company activity in the Atomic Energy Commission's power reactor program.

★ ★ ★

THE BABCOCK & WILCOX COMPANY has purchased a tract of land south of the city of Wilmington, N. C. and will start immediately to erect a new $2,000,000 plant to build boilers and related equipment.

★ ★ ★

THE BOARDS OF DIRECTORS of Commonwealth Edison Company and Public Service Company of Northern Illinois, upon the recommendation of Charles Y. Freeman, chairman, at a meeting held recently, made certain changes in the executive set-up of the companies. These changes were effective on March 1, 1953.

Mr. Freeman relinquished the position of chairman and chief executive officer and was elected chairman of the executive committees of Commonwealth Edison and of Public Service. He will continue to take an active part in the management of the companies and in the formulation of their policies.

Willis Gale, president, was elected chairman and chief executive officer of Commonwealth Edison and Public Service.

John W. Evers, executive vice-president, was elected president of Commonwealth Edison Company.

H. P. Sedwick, executive vice-president, was elected president of Public Service Company of Northern Illinois. Upon the merger of Public Service into Edison, Mr. Sedwick will be president of the Public Service Division.

★ ★ ★

P. C. SMITH will now be manager of the Westinghouse Electric Corporation's Transportation and Generator Division at East Pittsburgh, Pa.

The Transportation and Generator Division is one of the largest Westinghouse operating divisions, and builds large waterwheel and turbine generators; large motors; electric equipment for locomotives, trolley coaches, and street cars; and steel mill drive equipment.

★ ★ ★

FEATURING over 200 exhibits from universities and the electrical industry the 1953 equipment show of the Electrical Manufacturer's Representatives Association of Michigan will be held at the Exhibition Building of Detroit's Michigan State Fair Grounds, May 19 to 22.

The show is being staged during Michigan's *Electrical Week*, which begins May 18. This is a state-wide effort sponsored by the state's electrical industry to impress on the public the basic facts in the use of electricity.

★ ★ ★

ENGINEERING ADVANCES in the next five to ten years are likely to be faster than at any other time in history, Harry A. Winne, General Electric Company vice president of engineering, said recently in an engineering preview of the months ahead.

However, in accomplishing this, two major problems confront industry: one, where to find more engineers and two, how to get materials which will stand up under the ever-increasing stresses which designing engineers would like to place on them.

★ ★ ★

APPROXIMATELY $750,000 worth of mechanical draft equipment has been ordered by the Tennessee Valley Authority from Westinghouse Electric Corp.'s Sturtevant Division. The heavy equipment, designed for use with new boilers being erected at the TVA's Kingston, Tenn., Station, will include eight turbo-vane forced-draft fans, eight multivane induced-draft fans, eight 1750-hp motors, and eight 700-hp motors.

★ ★ ★

FIFTEEN FELLOWSHIPS will be offered in 1953 by the Institute of Gas Technology, an affiliate of Illinois Institute of Technology, it was announced by E. S. Pettyjohn, director of IGT.

Two programs are available for graduate students preparing for careers in the gas industry. One offers a master of science degree in mechanical or chemical engineering in 15 months, the other, a master of gas technology degree in two years. Outstanding students may be granted fellowship extensions for work on the doctor of philosophy degree.

Fellows receive tuition, fees, and a stipend, starting at $140 a month. Enrollment will be in mid-June, although exceptions may be made for winter graduates.

★ ★ ★

ONE OF THE SIGNIFICANT industrial trends during the past year was the increased use by industry of more and more instrumentation and automatic control equipment to help meet expanded production goals in face of a tight labor supply. This continued investment in industrial instrumentation in 1952 showed a 10 per cent rise over 1951 and represented many

new applications for both new and old instruments. All indications are that the trend toward wider use of instruments and controls will continue and will be a greater stimulant to greater volumes of business for the instrument industry, according to Henry F. Dever, president of the Brown Instruments Division, Minneapolis-Honeywell Regulator Company.

★ ★ ★

PHILIP SPORN TOLD GRADUATES of Illinois Institute of Technology at Commencement exercises in the Museum of Science and Industry recently, "The world can truly say to the engineer: you made me what I am today."

Sporn, who is president of the American Gas and Electric Company, one of the largest utilities companies in the U. S., declared that the engineer can be justly proud of his work.

The world of tomorrow we are seeking will never come into being without more engineering and engineers. The economic condition of great masses of the human race is so bad, their daily life is so miserable, that we must first improve their material well-being before we try to kindle faith and hope in our system of freedom in their hearts. That means the use of more tools and power, the development of greater skills — in short, more and better technology.

During the Commencement exercises, an honorary doctor of engineering degree was conferred on Sporn for his *distinguished leadership in the field of power systems engineering* by Dr. John T. Rettaliata, president of Illinois Tech.

★ ★ ★

AWARD of the 1952 Lamme Gold Medal to I. F. Kinnard, of the General Electric Co., West Lynn, Mass., was announced today by H. H. Henline, Secretary of the American Institute of Electrical Engineers. Mr. Kinnard is engineering manager of the Meter and Instrument Department of General Electric at West Lynn.

The Medal has been awarded to Mr. Kinnard "for his outstanding contributions in design and developments in instrumentation and measurements". It will be presented during the Summer General Meeting of the Institute at Atlantic City, June 15–19 by Donald A. Quarles, of Albuquerque, N. M., president of AIEE.

Mr. Kinnard was graduated from Queen's University, Kingston, Ontario. After service with the Engineering Corps in the Canadian Army during World War I, he studied at the University of Glasgow and from 1919 to 1922 was a research engineer with Westinghouse Electric Corp. He has been chairman of the GE Company-wide Magnetic Materials Committee and a member of the Engineering and Research Council. He was a member of the AIEE Board of Examiners, 1946–50, and served for 18 years on the Instruments and Measurement Committee, two years as chairman.

He is a member of the National Electrical Manufacturers Association and since 1952 has been chairman of their Electrical Measuring Equipment Committee.

★ ★ ★

LARGEST in the Public Service Electric and Gas Co. system, and the first of two to be installed in the company's new Kearny Generating Station a 145,000-kw. turbine generator was placed in service this week. The second generator will go on the line later this year. The new station is located adjacent to the original Kearny Station, which went into service in 1926.

The 145,000-kw turbine generator will be operated at 2350 psi, and an initial temperature of 1100 F, with reheat to 1050 F after passing through part of the turbine. It will generate electricity at 20,000 v.

This turbine generator will be the first unit in the world to utilize steam at this high pressure and temperature and will be capable of supplying, alone, the household electric needs of approximately 450,000 people.

★ ★ ★

TO MEET rapidly increasing electrical power requirements for additional machine tools and testing at Allis-Chalmers West Allis Works, J. D. Greensward, vice president and director of manufacturing, general machinery division, has announced a $3,000,000 power modernization and expansion program.

Greensward said modernization and expansion of the firm's powerhouse facilities included a new steam turbine, installation of a new boiler, rebuilding of the main substation, modernization of the coal handling system. In addition a new substation will also be installed.

A new 7,500-kw steam turbine will supply 7½ times the power of the unit it replaces. A new boiler with a capacity of 150,000 lb per hr of steam will also be installed.

Another important phase of the power expansion project will be rebuilding the firm's main substation. This will enable Allis-Chalmers to purchase additional power from the Wisconsin Electric Power Co. to meet increased demands. A new substation is being installed to furnish increased power for the tractor shops.

In addition, the coal handling system will be modernized. The powerhouse now burns an average of 300 tons of coal a day. A railroad spur will be added, making it possible to line up six coal gondolas at a time for unloading. Coal will be moved to the powerhouse bunkers by means of an overhead continuous belt conveyor.

Much of the new equipment including the turbine generator, condensers, boiler feed pumps, motors, switchgear and transformers will be manufactured at the West Allis Works.

Allis-Chalmers recently has added many large new tools to its production lines including a 30-foot boring mill, many new smaller boring mills, and a new planer and slotter. Increased power is necessary to operate these tools. Greensward said the entire program reflected the growth of the use of electricity in the United States and the anticipated demand by utilities, industry and users of farm and construction machinery for equipment.

★ ★ ★

DEVELOPMENT of a coal-burning gas turbine has reached such a stage that intensive work on possible commercial applications, particularly for locomotives, is to get under way. This was the basis for a joint announcement, made recently by President Roy B. White of the Baltimore and Ohio Railroad, chairman of the Locomotive Development Committee of Bituminous Coal Research, Inc., and Perry T. Egbert, president, American Locomotive Co., of an agreement between the coal industry's research agency and Alco that will make possible a stepped-up developmental program.

The two executives said that a contract has been signed between Bituminous Coal Research, Inc., and the American Locomotive Co. Under this agreement, Alco will carry on development of the turbine for commercial applications and design a chassis for locomotive use. The joint program of continued research and development will be carried out by BCR's Locomotive Development Committee and the locomotive-building firm.

Researchers for the Locomotive Development Committee, representing a group of nine major coal-carrying railroads and five of the nation's largest coal companies, have carried on the coal-burning gas turbine research program since 1945 as reported periodically in POWER ENGINEERING. An extensive high temperature test program was completed recently at the Dunkirk, N. Y. plant of the American Locomotive Co., with bituminous coal being used exclusively to fuel a 4250-hp turbine of a type contemplated for locomotive use. Future plans of the joint BCR-Alco project call for further development of power plant components and additional operation of the Dunkirk experimental equipment prior to road service tests.

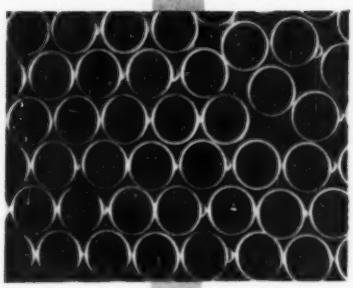
★ ★ ★

PAUL W. PEARSON, President of the Industrial Equipment Co., 315 N. Ada Street, Chicago 7, Illinois, announces that the firm name has been changed to Industrial Crane & Hoist Corp.

★ ★ ★

AT THE AMERICAN POWER CONFERENCE in Chicago, March 25–27, the National Association of Power Engineers elected as president for the coming year Gerald Mierendorf, superintendent of power plants for the A. O. Smith Corp. of Milwaukee. He also becomes chairman of the board and chairman of the publications committee which edits *National Engineer*.

What Proves the Worth of a Boiler Tube?



Claims of dependability . . . of consistently uniform wall thickness, diameter, and physical properties . . . of freedom from scale, slivers, pitting, and other defects inside and outside a tube, are common—*and true*—for all quality boiler tubes regardless of the mill that supplies them. They are true because *all boiler tubes must conform to the same specifications for the same jobs.* Side-by-side they're "look-alikes," yet there is a difference . . . a difference that only *time* can prove under the grueling conditions of heat, pressure, corrosion, and oxidation found inside a modern boiler. B&W boiler tubes have met this test of time in boilers serving the widest variety of applications . . . utilities, industries, government institutions, hospitals, office buildings, apartment houses . . . wherever fine boilers are operating efficiently over extended periods.

Say B&W before you say WELDED BOILER TUBES—for Service-Proved Dependability.

For three-quarters of a century, B&W has been directly concerned with developing and applying boiler tubes for lowest pressures up to those approaching 3000 psi. The application of this extensive knowledge and experience results naturally in the production of finer boiler tubes.

B&W dependability is proved by time and endorsed by hundreds of customers who keep coming back for more . . .

B&W WELDED BOILER TUBES.

B&W SEAMLESS and WELDED TUBES

THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION
Beaver Falls, Pa.—Seamless Tubing; Welded Stainless Steel Tubing
Alliance, Ohio—Welded Carbon Steel Tubing

TA-1742 (A)

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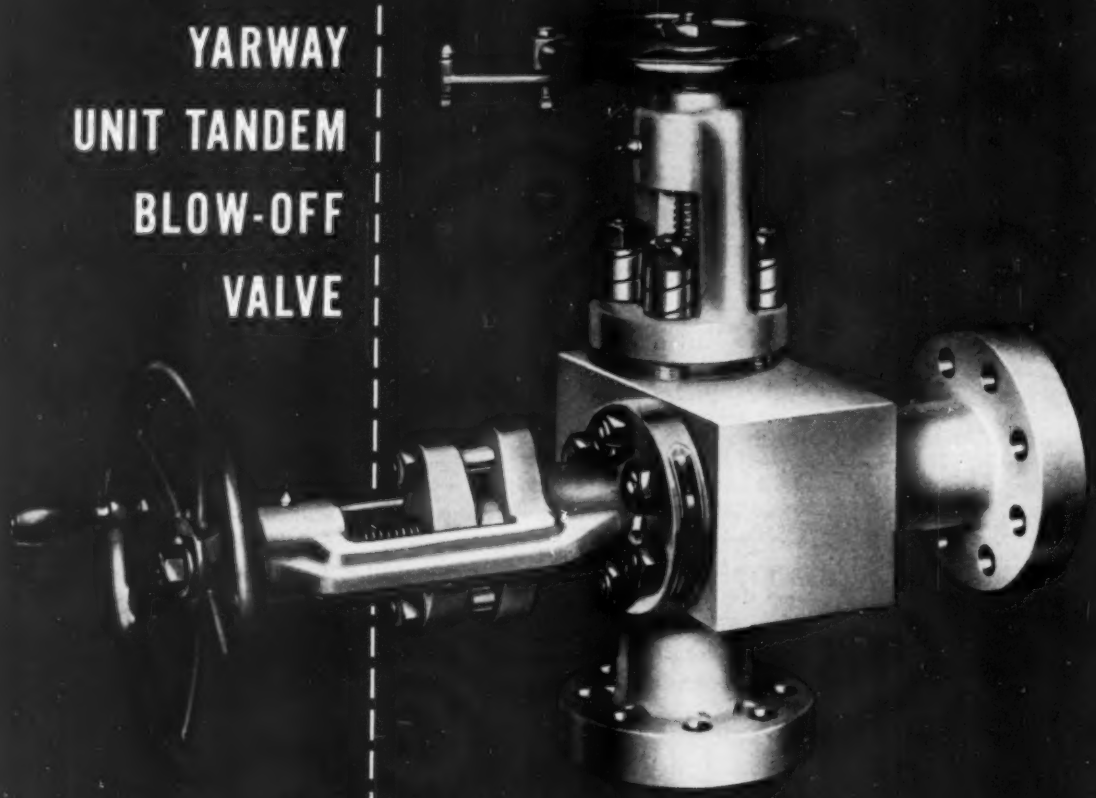
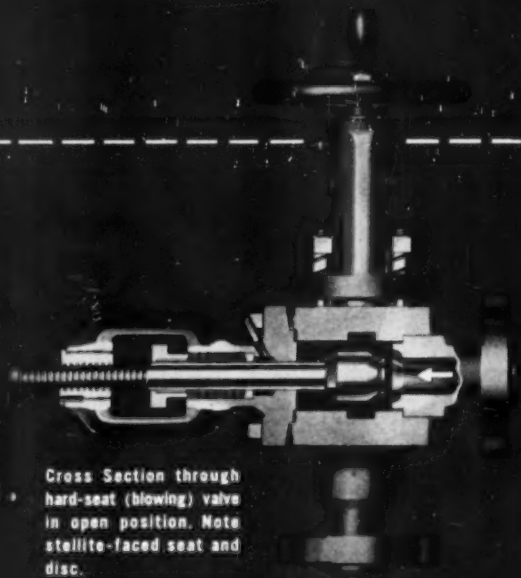
YARWAY UNIT TANDEM BLOW-OFF VALVE

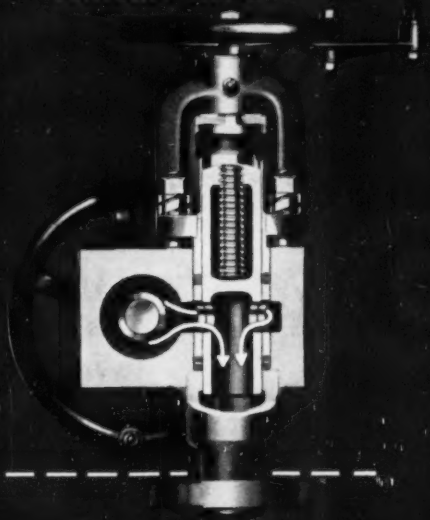


CROSS SECTION HARD-SEAT VALVE



Cross Section through hard-seat (blowing) valve in open position. Note stellite-faced seat and disc.

CROSS SECTION
SEATLESS VALVE



Cross Section through seatless (sealing) valve in open position. (On pressures over 1500 psi two hard seat valves are recommended.)

RUGGEDNESS

...WHERE YOU NEED IT

A one-piece forged steel block serves as the common body for both valves in Yarway Unit Tandem Blow-Off Valves.

You get rugged strength where you need it ... added protection for your high pressure boilers.

Whether in times of emergency, normal blowdown service, or acid washing, this high safety factor is a source of satisfaction to boiler plant operators.

Yarway Unit Tandems combine all advancements of modern metallurgy with experienced design and skilled workmanship. The result—DEPENDABLE PROTECTION.

POSITIVE ACTION

...WHEN YOU NEED IT

When putting high pressure boilers on the line, or in times of emergency, you need positive action at the blow-off valves.

With Yarways you have it.

Both the hard seat-seatless combinations and the hard seat-hard seat combinations provide positive opening and closing with drop-tight shut-off. Open yokes permit visual indication of the disc position in the hard seat valve and of the plunger in the seatless valve.

These are some of the reasons why *more than 4 out of every 5 high pressure plants in the United States are Yarway-equipped* and among boiler plants of all pressures, *more than 16,000 are Yarway-equipped*

Write for your free copy of Yarway Blow-Off Valve Bulletin B-425 (pressures to 400 psi) or Bulletin B-433 (pressures to 2500 psi).

YARNALL-WARING COMPANY
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YARWAY®

blow-off valves

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PROMPT, experienced service is one of the most important plus values you get when you buy Honeywell instruments. An unequalled organization of trained specialists is always at your call at more than 110 offices in the United States and Canada. Offices are located in practically every large industrial city of the country . . . close to every major production center.

Trained Personnel

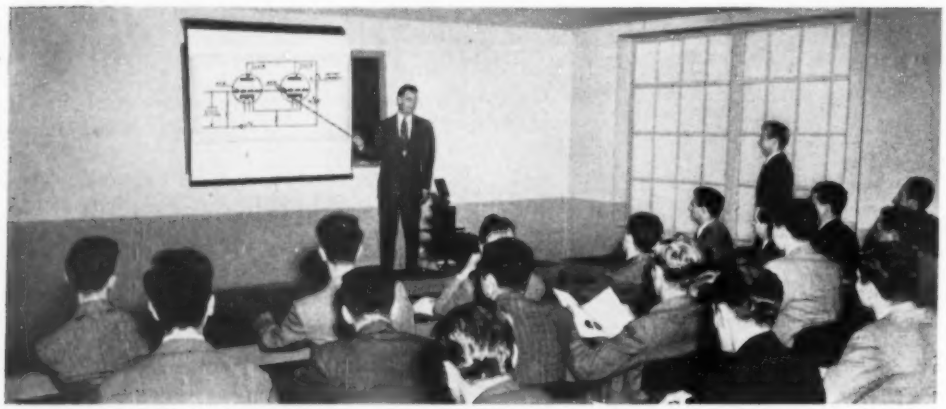
Honeywell service men are schooled not only in the theory of measurement and control, but also in the practical art of keeping good instruments in the best condition. Hand picked men begin this instrument education in an intensive training program in Honeywell factories. After graduation, they serve an apprenticeship in the field offices . . . while they learn still more about instrument maintenance from first-hand contact with plant problems. By the time a Honeywell man arrives at your plant on a call, he's a finished product worthy of the responsibility he bears, and capable of doing the kind of service job that you need . . . and that your Honeywell instruments deserve.

When trouble strikes, a wire or telephone call will bring a service man to your plant . . . often within a few hours. This assurance of prompt action means a lot to your production schedules. You'll never be left out on a limb because of delays in instrument maintenance.

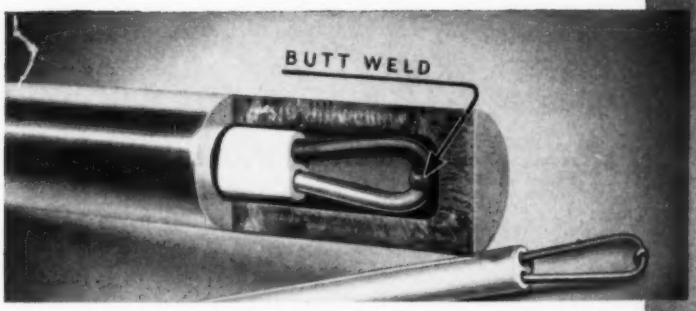
Periodic Service Plan

But why wait for emergencies? Preventive medicine works on instruments, too. And the prescription is simple . . . a Periodic Service Contract, which brings a Honeywell service man to your plant at regular intervals to inspect, clean and adjust any Honeywell instruments you have. The plan is economical . . . can save you many hours of lost production time. Your nearest Honeywell office will be glad to give you full details.

A faster, stronger *for steam*



TRAINED TO SERVE: *In Honeywell's service school, students get a thorough grounding in instrument theory and practice. After graduation, they become part of the most extensive organization of its kind in the world . . . ready to serve you competently and promptly, whenever and wherever you need them.*



FOR getting high-speed, precise measurements of steam temperatures, the Brown butt-welded thermocouple is the ideal partner for *ElectroniK* instruments. This thermocouple's unique characteristics come from an entirely new kind of design, in which the two couple wires are electrically welded together in a butt joint.

The thermocouple is *faster*—because the mass of the junction is much smaller than the usual twisted joint. It's *stronger*—withstands vibration and shock better. And it's *more accurate*—because the loop formed at the joint prevents heat conduction from the junction back to the insulators.

A wide line of thermocouple wells is supplied for various steam plant applications . . . including a series especially designed for high pressure steam lines. All Brown thermocouple wells are precision-machined to highly uniform wall thickness, to guarantee dependability at high temperatures and pressures. They are available in a broad choice of standard sizes and designs, supplemented by special types made to individual specifications.

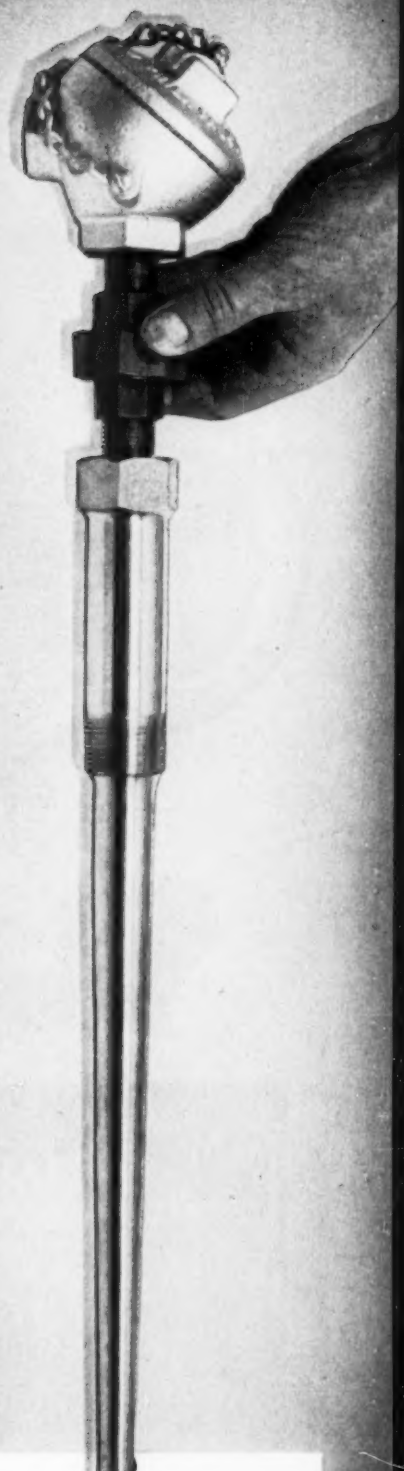
thermocouple *plant temperatures*

For specifying and purchasing all instrument supplies and accessories, you'll find new convenience and economy in the Honeywell Supplies Man—HSM—Plan. Your local HSM will be glad to explain the plan in detail, and to show you how planned buying can save you time and trouble. Call him today . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4587 Wayne Ave., Philadelphia 44, Pa.

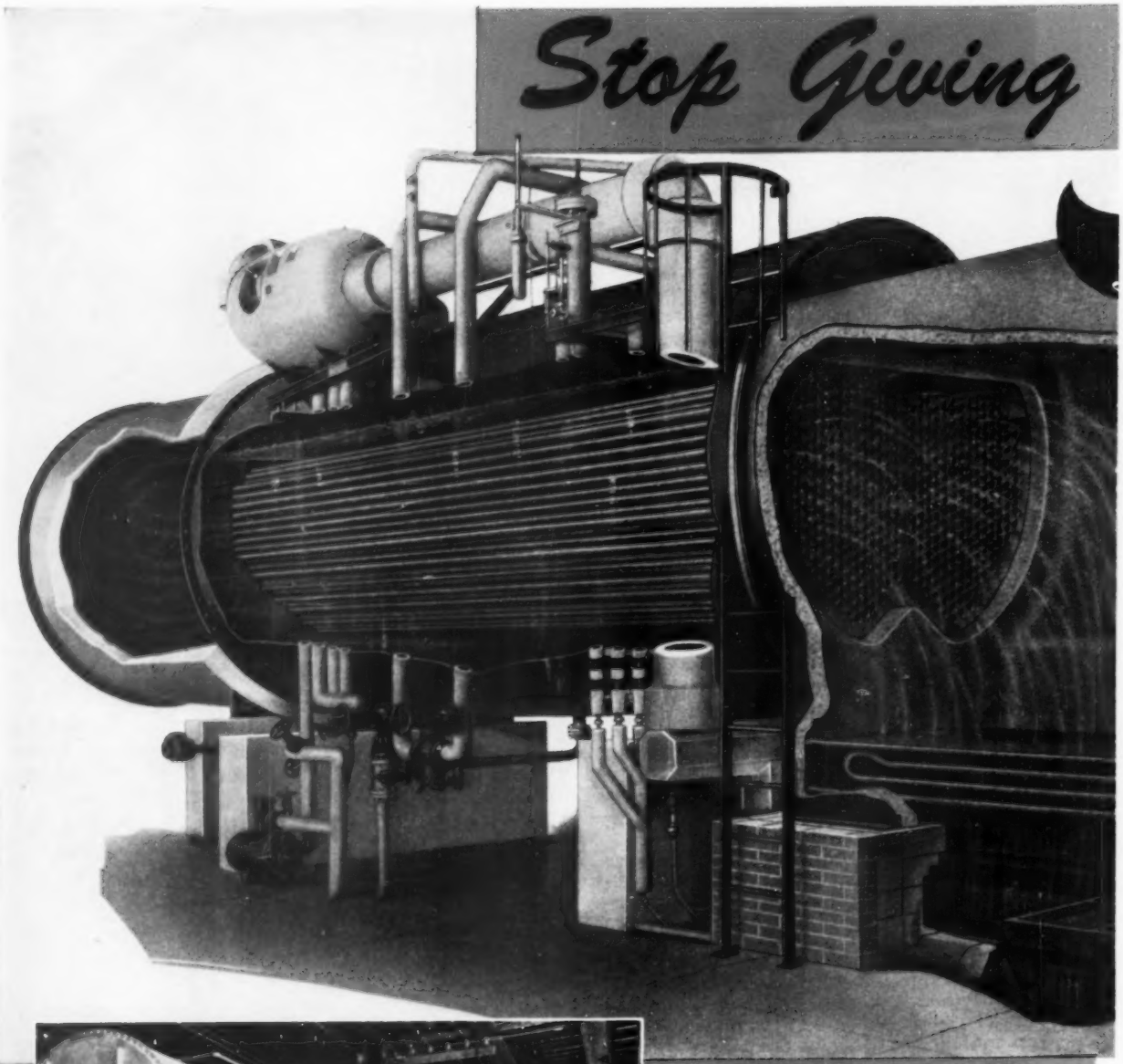
● **REFERENCE DATA: Write for Pyrometer Supplies Buyers' Guide No. 100-4 . . . and for Specification Sheet No. 200-2 on Thermocouple Wells.**

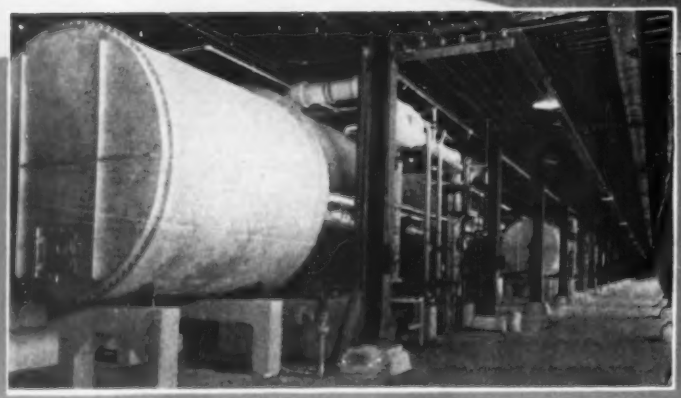
MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls



STEAM THERMOCOUPLE *has tapered stainless steel well, precision-drilled to highly uniform wall thickness. Inset shows butt-welded thermocouple junction. The small mass gives fast response . . . curved wires prevent heat conduction away to the insulators.*

Stop Giving





10 Erie City Fire Tube Boilers each "fired by" waste heat gases from an Open Hearth Furnace

Boilers (10) . . Erie City Fire Tube

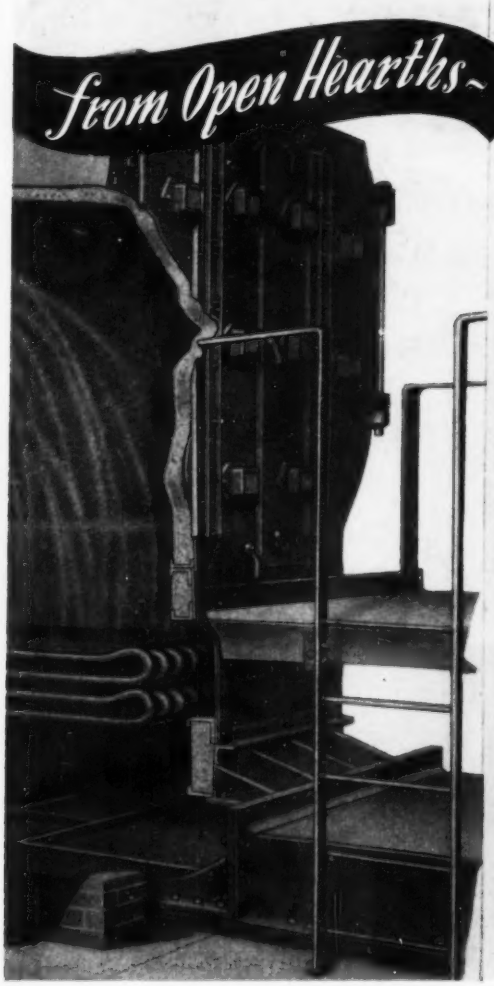
Design Pressure . . . 300 p. s. i.

Capacity . . . . 15,000 lbs/hr.

Superheater Steam Temperature . . . 525° F

Fuel . . Waste gases from Open Hearth furnace enter boiler at about . . . . 1200° F

WASTE HEAT a free ride



or from your

- **Nickle Furnaces**
- **Zinc Furnaces**
- **Copper Furnaces**
- **Cement and Lime Kilns**
- **Incinerators**
- **Ore Roasters**
- **Silicate Furnaces**
- **Chemical Industry Furnaces**
- **Paper Industry Furnaces**

IN these days of increased operating costs investigate the economy of waste heat recovery. A large steel producer tapped a source of wasted B.t.u.'s from 10 Open Hearths and converted them into 150,000 lbs. of 525° superheated steam per hour. Fuel is the big cost in steam generation; therefore "free fuel" will give you a head start in your steam generating program.

Erie City manufactures a complete line of fire tube and water tube waste heat type boilers and has wide experience in heat recovery.

Outline your waste heat conditions—our experience is yours for the asking.

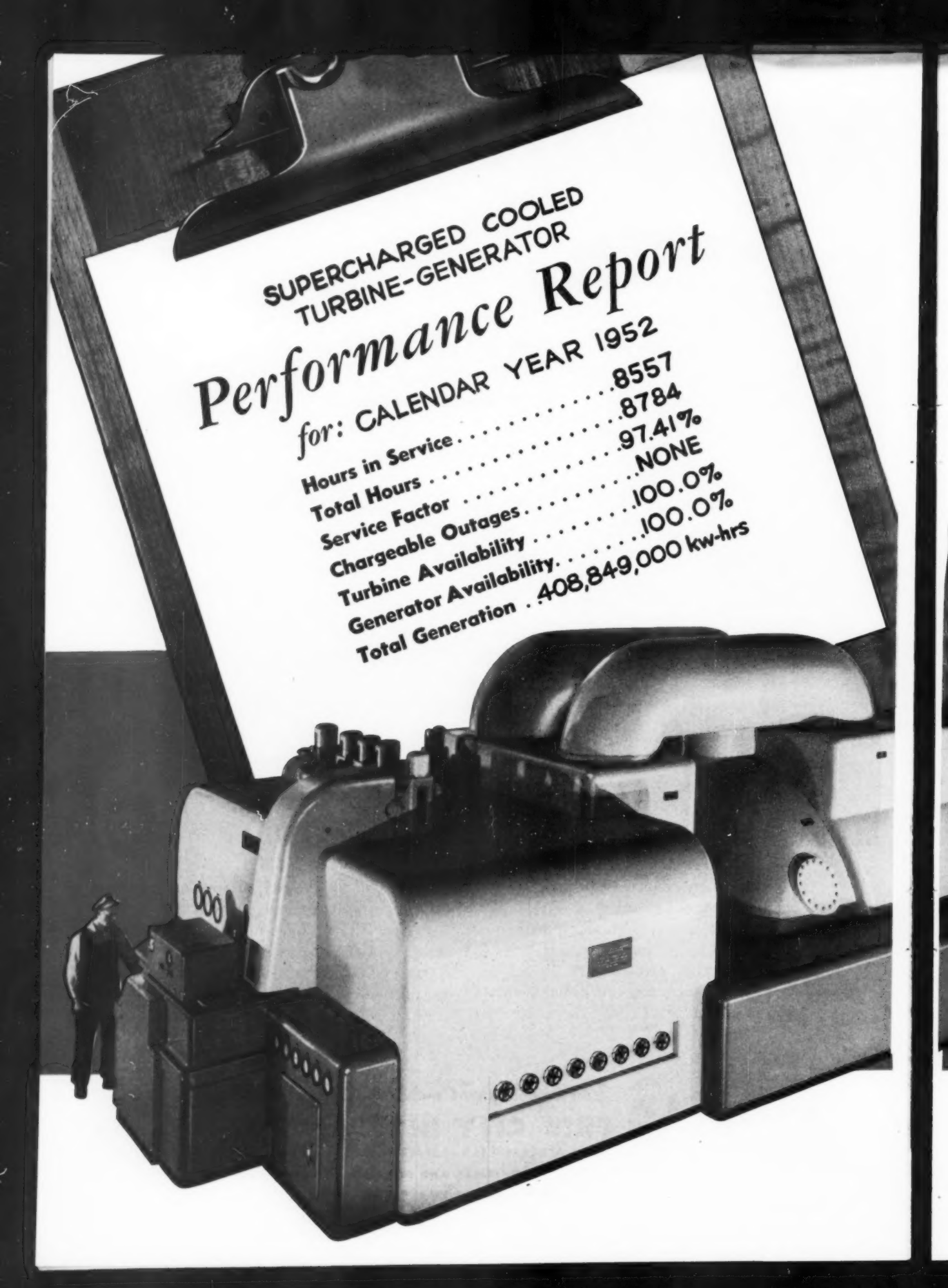
ERIE CITY
112 Years in Steam Generation

You can depend on Erie City for sound engineering

ERIE CITY IRON WORKS • *Erie, Pa.*

STEAM GENERATORS • SUPERHEATERS • ECONOMIZERS • AIR PREHEATERS
UNDERFEED AND SPREADER STOKERS • PULVERIZERS

For more data circle 507 on Post Card


SUPERCHARGED COOLED
TURBINE-GENERATOR
Performance Report
for: CALENDAR YEAR 1952
Hours in Service 8557
Total Hours 8784
Service Factor 97.41%
Chargeable Outages ..... NONE
Turbine Availability 100.0%
Generator Availability 100.0%
Total Generation .. 408,849,000 kw-hrs

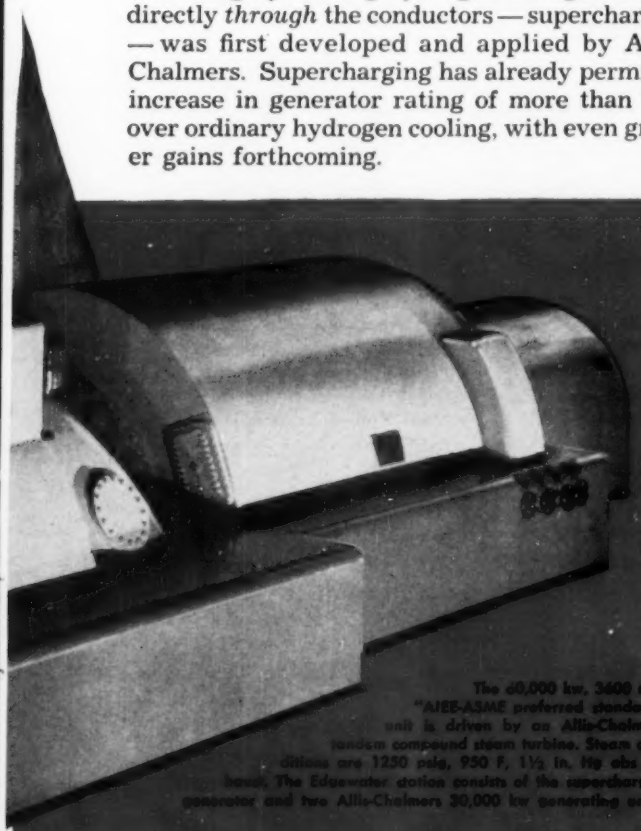
Availability for Duty: 100.0%!

Supercharged Hydrogen Cooling — the greatest advance *ever* made in turbine generator design — has proved itself brilliantly in its first full year's commercial operation!

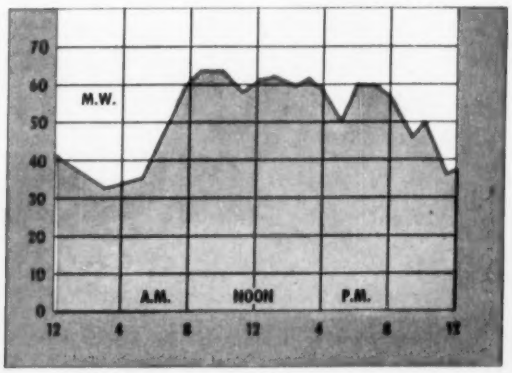
At left is the calendar year 1952 Performance Report on the Allis-Chalmers 60,000 kw steam turbine generator unit at the Edgewater station, Sheboygan, Wisconsin Power and Light Company. Both turbine and generator Availability were 100.0%, with on-the-line Service Factor over the entire year being 97.41%.

Cooling by driving hydrogen at high velocity directly *through* the conductors — supercharging — was first developed and applied by Allis-Chalmers. Supercharging has already permitted increase in generator rating of more than 70% over ordinary hydrogen cooling, with even greater gains forthcoming.

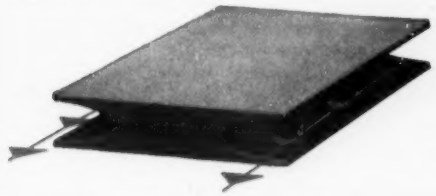
You get the real design advances *first* from Allis-Chalmers, builder of the world's widest range of power plant equipment. When planning a steam-electric power plant, your task will be simpler and results better if you deal with Allis-Chalmers. For complete literature on all products, call your nearest A-C office or write to Allis-Chalmers, Milwaukee 1, Wisconsin. A-3981



The 60,000 kw, 3600 rpm "AIEE-ASME preferred standard" unit is driven by an Allis-Chalmers tandem compound steam turbine. Steam conditions are 1250 psig, 950 F, 1½ in. Hg abs exhaust. The Edgewater station consists of the supercharged generator and two Allis-Chalmers 30,000 kw generating units.



Typical daily load cycle of the Sheboygan supercharged unit. It experiences wide load fluctuations because it operates in parallel with base load hydro power. Supercharged units are suited for even this strenuous duty because of high part load efficiency and shorter, more thermally stable construction.



Cross sectional view, showing two turns of typical supercharged conductor construction. The cooling gas is in intimate contact with the copper, removing the heat right where it originates. The heat does *not* have to migrate through insulation and surrounding metal to reach vent ducts in the rotor teeth or body.

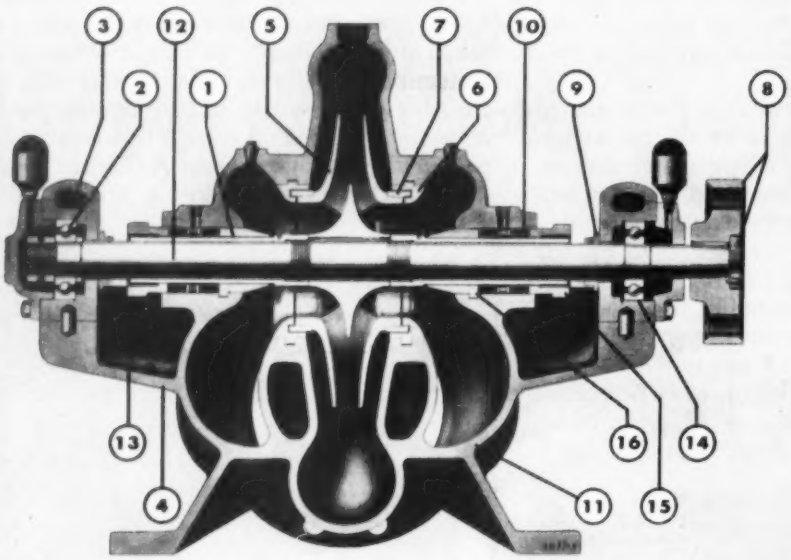
ALLIS-CHALMERS

FIRST with Supercharged Hydrogen Cooling!

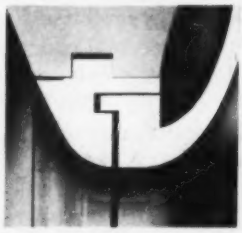
For more data circle 508 on Post Card

DE LAVAL
SINGLE STAGE CENTRIFUGAL PUMPS

for dependable industrial service



Labyrinth wearing rings minimize leakage...maintain high efficiencies



Labyrinth rings used in these De Laval pumps retard flow of water through labyrinth passage.

Flat rings showing relatively unimpeded flow of water.

(1) **Shaft Sleeves** are screwed on, to abut the impeller and make a water-tight joint. Sleeve expands freely and independently of shaft when temperatures change. There is no tendency to buckle.

(2) **Thrust Bearing** locates rotor axially.

(3) **Bearing Caps** easily removable for maintenance.

(4) **Bearing Brackets** scraped to lining bars for perfect alignment.

(5) **Impeller** hydraulically balanced, finished on all surfaces.

(6) **Labyrinth Wearing Rings** held accurately in machined grooves in both case and cover.

(7) **Impeller Wearing Rings** threaded on impeller, opposite to rotation.

(8) **Flexible Coupling** ground on all exposed surfaces and statically balanced, complete coupling supplied, pump half mounted on taper so that it can be easily removed. Check nut locks coupling on taper.

(9) **Deflector** keeps water out of bearing.

(10) **Stuffing Boxes** extra deep; lantern rings for water sealing.

(11) **Pump Case** horizontally split; machined to limit gages.

(12) **Steel Shaft** ground to limit gages.

(13) **Drip Boxes** large; provided with drain openings.

(14) **Radial Bearing** free to move axially, thus avoiding temperature strains.

(15) **Glands** split horizontally.

(16) **Protecting Bushings** renewable.

You can count on the performance of the De Laval Single Stage Centrifugal Pumps because they are precision-made to high manufacturing standards and incorporate the many quality design features shown in the cross-section.

They operate at high or low speeds, at high or low heads...with maximum efficiency.

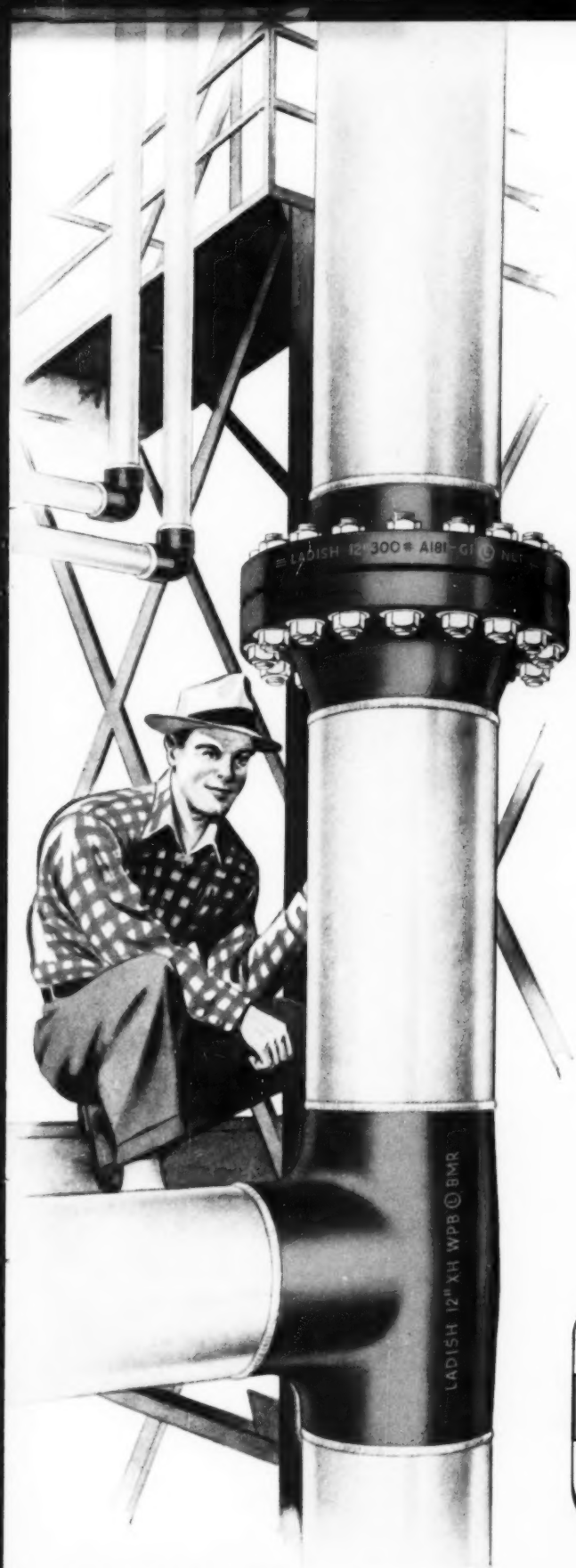
For example, De Laval G, I and K Single Stage Double Suction Pumps have a capacity range of 175 gpm to 6,000 gpm, and heads to 300 feet. They are available in sizes ranging from 4" suction and 3" discharge to 14" suction and 12" discharge. Write for Bulletin 1002.

DeLaval also furnishes larger centrifugals for capacities up to 70,000 gpm. Bulletin 83-29R sent on request.

DE LAVAL *Centrifugal Pumps*

DE LAVAL STEAM TURBINE COMPANY
816 Nottingham Way, Trenton 2, New Jersey

For more data circle 509 on Post Card



LADISH

Controlled Quality

PIPE FITTINGS

maximum service assured by metallurgical soundness

Sound metallurgy . . . the result of unsurpassed facilities and advanced laboratory controls . . . provides the maximum of dependability in Ladish Controlled Quality fittings. Every phase of metal quality . . . composition, structure and physical properties . . . is continuously safeguarded — and certified proof of metallurgical integrity is available to users of Ladish fittings.

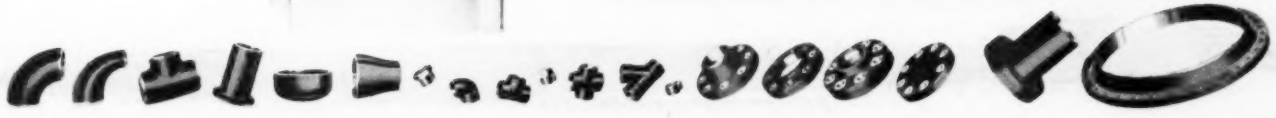
TO MARK PROGRESS

THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

LADISH CO.

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago • St. Paul
St. Louis • Atlanta • Houston • Tulsa • Los Angeles • San Francisco • Havana • Mexico City • Brantford, Ont.



"He Might Need It..."

"He never was much for letter-writing when he was in college. But he must know how anxious Mother and I are . . . now that he's off in Korea. Haven't heard from him in six weeks. Of course, they say 'no news is good news' . . . but I wonder. Maybe he can't write . . . because . . . maybe he's in a hospital somewhere. And maybe he needs blood. I don't know . . . but I'm not taking any chances. That's why *I'm* giving blood."

★ ★ ★

Yes, all kinds of people give blood —for all kinds of reasons. But whatever *your* reason, this you can be sure of: Whether your blood goes to a combat area, a local hospital, or for Civil Defense needs— this priceless, painless gift will some day save an American life!

Give Blood Now

CALL YOUR RED CROSS TODAY!

NATIONAL BLOOD PROGRAM

Business Executives! ✓Check These Questions!

If you can answer "yes" to most of them, you—and your company—are doing a needed job for the National Blood Program.

- ☐ Have you given your employees time off to make blood donations?
- ☐ Has your company given any recognition to donors?
- ☐ Do you have a Blood Donor Honor Roll in your company?
- ☐ Have you arranged to have a Bloodmobile make regular visits?
- ☐ Has your management endorsed the local Blood Donor Program?
- ☐ Have you informed employees of your company's plan of cooperation?
- ☐ Was information given through Plant Bulletin or House Magazine?
- ☐ Have you conducted a Donor Pledge Campaign in your company?
- ☐ Have you set up a list of volunteers so that efficient plans can be made for scheduling donors?

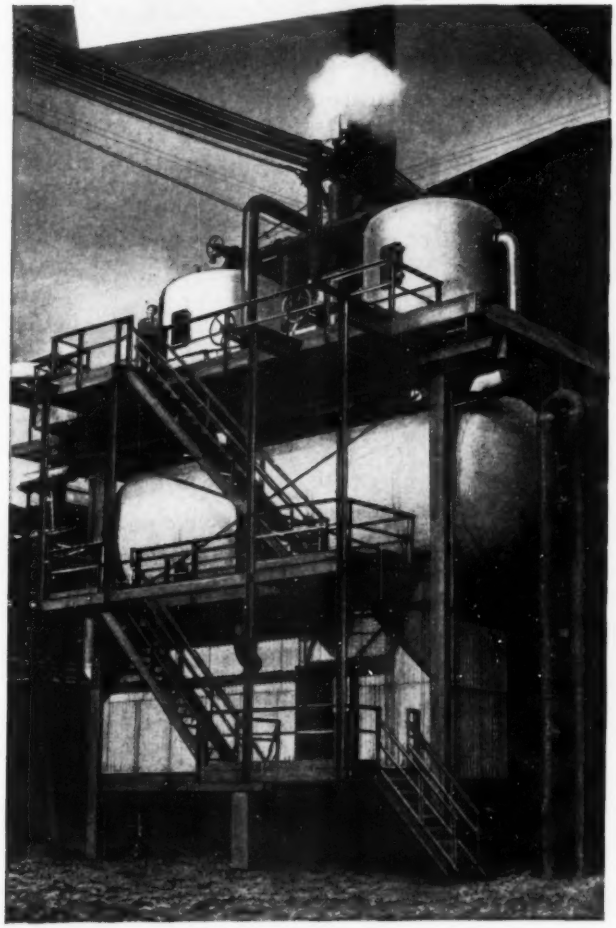
Remember, as long as a *single* pint of blood may mean the difference between life and death for *any* American . . . the need for blood is *urgent!*

· THIS

DEAERATION PROBLEM

1,000,000 pounds of highly corrosive encrusting feedwater, with hardness up to 35 ppm and temperature at 60F, to be deaerated for boilers operating under *variable load* conditions at 225 psig and 575-600F at a large eastern steel mill.

Solved by Graver



THE GRAVER SOLUTION

Two Graver Spray-Tray Deaerating Heaters mounted on a single horizontal storage tank and equipped with internal vent condensers.

Graver non-clogging, non-corrosive spray valves are used for first-stage deaeration, and stainless-steel non-corrosive trays are used for second stage deaeration.

A Graver internal vent condenser eliminates the possibility of tube scaling which would occur in an external tubular condenser at lower load conditions.

THE GRAVER PERFORMANCE

Even under varying load conditions, tests show that O_2 is kept below 0.005 ml/l, and the entire installation operates without any maintenance attention.

• • • • •

Graver can help solve *your* deaeration problem, too. The more than 40 years of specialized experience of the Graver water conditioning engineers is at your service. Write for free copy of "Trends in Application of Deaerating Heaters for Treating Boiler Feedwater"

GRAVER WATER CONDITIONING CO.
Division of Graver Tank & Mfg. Co., Inc.
Dept. PE-H, 216 West 14th Street, New York 11, N. Y.

In Canada: The Bird-Archer Co., Ltd.; Cobourg, Ontario
In Mexico: Proveedores Tecnicos, S.A.; Puebla 259, Mexico 7, D. F.

GRAVER ***Deaerating Heaters***

GW 462

For more data circle 511 on Post Card

no other UNIT STEAM *can offer* ALL *these* QUALITY

with PREFERRED there *IS* a

– and the difference (or differences) between Preferred Unit Steam Generators and ordinary job-shop "package-units" can be readily checked and performance compared, because with Preferred –

There's a difference in your installation costs—they're lower—because Preferred eliminates necessity for expensive stacks, separate power houses, and special foundations. With the entire unit, including boiler, burner, and all controls mounted on a common base, occupying 50% less space than ordinary equipment for comparable output, your Preferred unit can be moved into place in one morning, service lines hooked up, the boiler vented to outside and you're making steam!

—carefully-kept records prove Preferred offers major operating economies that continue, year after year, to be reflected in lowered product-cost advantages—

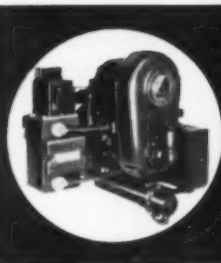
—and the difference lies in Preferred's lower operating costs! The result of more than a quarter of a century of combustion engineering experience, each Preferred unit has an average life expectancy of 25 years AND a guaranteed thermal efficiency of 80%!

Progressive development engineering and constant research, backed by proven design advantages, all combine to deliver constantly efficient combustion with all types of light or heavy oil, natural or manufactured gas, fired singly or in combination.

Complete engineering service for your combustion problems available on request to your nearest Preferred Representative or write direct, no obligation.

PREFERRED UTILITIES — Rigged for Results — ENGINEERED

Only PREFERRED *can*



Quality Feature #10

Horizontal Rotary Oil Burner. Starts, ignites, follows load, shuts off, cleans and purges itself automatically.

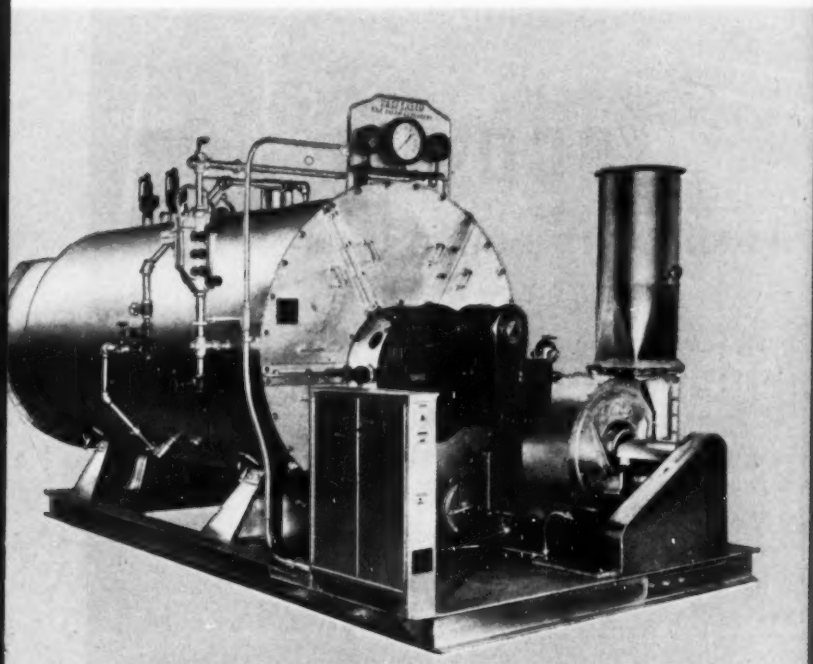
Quality Feature #9

DUAL PURGING ACTION. An important safety factor. Entire vessel is purged of gas vapors before and after firing.

PREFERRED UTILITIES MANUFACTURING

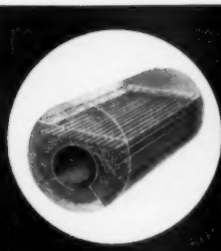
GENERATOR FEATURES . . . DIFFERENCE!

If you want dependable, modern, *efficient* combustion that will help your company get more steam—*at less cost*—you'll want to check these Preferred features that give you a 25-year assurance *and*—less cost per manufactured or processed unit!



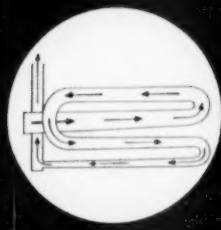
PREFERRED UNIT STEAM GENERATOR

Quality Feature #1



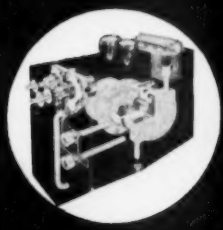
5 SQUARE FEET OF HEATING SURFACE per boiler horse power. Heat transfer surface commensurate with long life and high efficiency.

Quality Feature #2



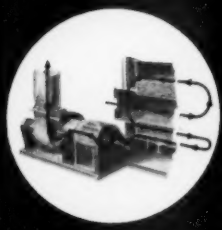
FOUR PASS GAS TRAVEL assures uniform distribution of generated heat. Clean heat transfer surfaces to minimize tube cleaning and lower stack temperature.

Quality Feature #3



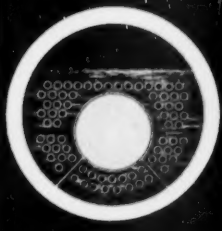
In conjunction with a constant displacement pump and positive, reciprocal, proportionate gearing, the "Voluvalve" Fuel Regulator supplies metered oil to fuel feed system.

Quality Feature #4



INDUCED DRAFT. Smoother starting, higher combustion efficiency, less refractory upkeep, eliminates poisonous fumes in boiler room.

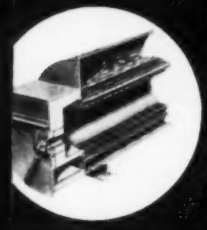
Quality Feature #5



INTERMEDIATE FURNACE POSITION. Protects tube areas, safeguards shell from unequal heat distribution.

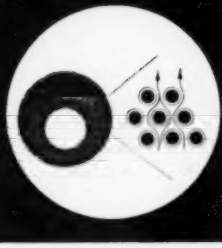
...offer you ALL THESE FEATURES!

Quality Feature #8



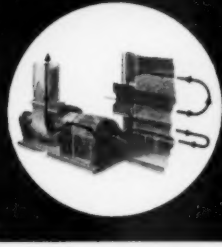
ANTI-STRESS DECK. Keeps sections of rear tube sheet—above and below water line — in close balance. Prevents unequal stress action within tube area.

Quality Feature #7



STAGGERED TUBES. Thorough wiping of entire tube surfaces during maximum or minimum operation. Faster heat pick-up rate.

Quality Feature #6



EXPANSILE PRECIPITATOR. Clean, smokeless operation. Maximum gas velocities maintained equally in all tubes of pressure vessel.

CORPORATION 1860 BROADWAY • NEW YORK 23, N. Y.

For more data circle 512 on Post Card

Know the pitch!

Specify SCOVILL PHOSPHORIZED ADMIRALTY HEAT EXCHANGER TUBES

With Scovill men and methods on your team, you will get plenty of practical, helpful "signals" to long-life heat exchanger tube performance.

Scovill Phosphorized Admiralty Tube (Alloy 363), for example, is *made* differently... hot extruded from CONTINUOUS-CAST billets. As a result, it is *always* uniform in composition and temper; inhibitor content (phosphorus) is *always* at optimum percentage. Such tube shows superior resistance to corrosion and dezincification, especially where contaminated fresh, salt, or brackish waters are used in the circulation system.

Equally important, Scovill provides what many consider to be the most competent and comprehensive Heat Exchanger Tube Technical Service in the field. We make it our business to see that you get the right tube for your application and conditions... selected from the wide range of heat exchanger tube alloys we produce.

Inquiry and an outline of your needs are encouraged. Write on your business letterhead for our 40-page heat exchanger tube booklet. Scovill Manufacturing Company, 99 Mill Street, Waterbury 20, Conn.

SCOVILL
HEAT EXCHANGER TUBE ALLOYS

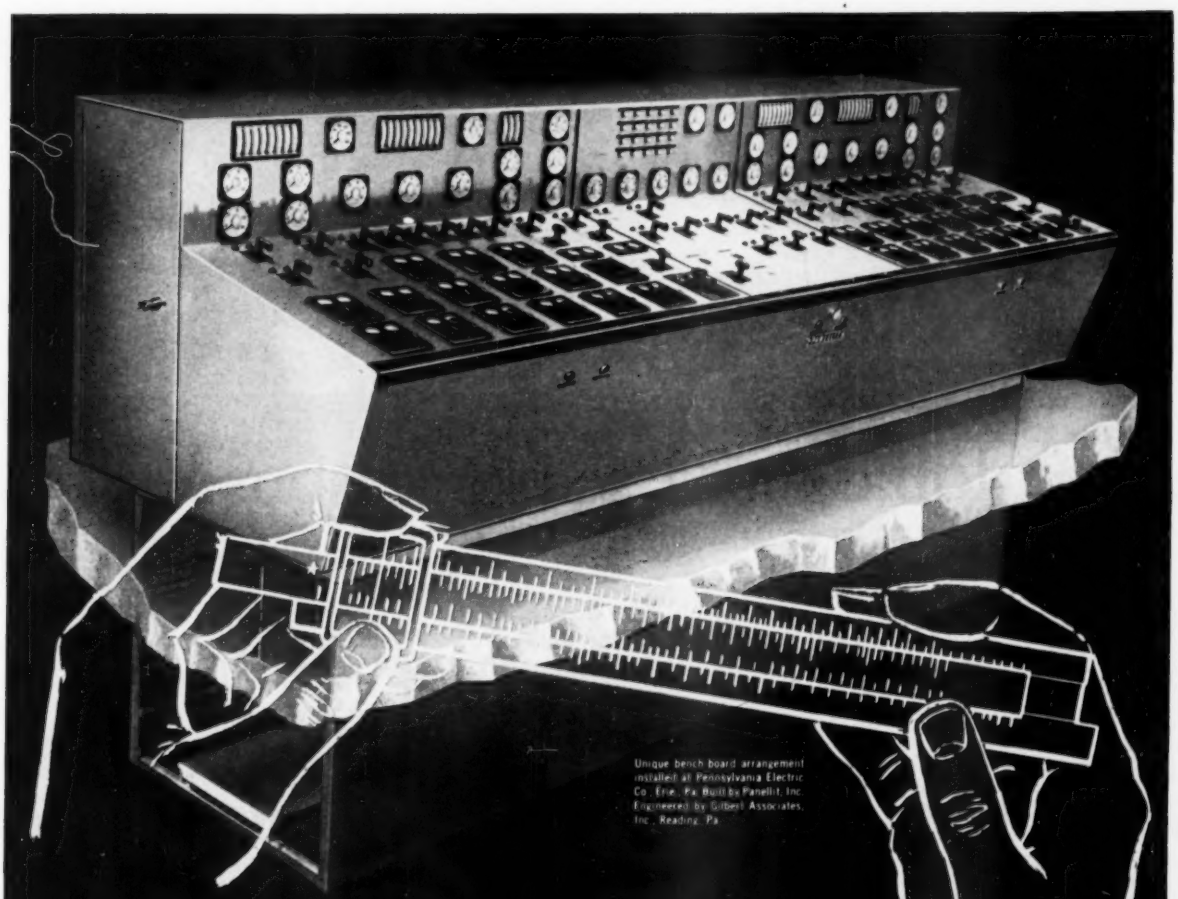
- PHOSPHORIZED ADMIRALTY
- ADMIRALTY
- ARSENICAL ADMIRALTY
- MUNTZ METAL
- NAVAL BRASS
- RED BRASS, 85%
- DEOXIDIZED COPPER
- ARSENICAL COPPER
- COPPER NICKEL, 10% & 20%
- CUPRO-NICKEL, 30%
- CUPRO-NICKEL, 30% (High Iron)
- ALUMINUM BRASS
- ALUMINUM BRONZE, 5%
- DUPLEX TUBE

SCOVILL

29C93

"You can't buy better Brass"

For more data circle 513 on Post Card



Unique bench board arrangement installed at Pennsylvania Electric Co., Erie, Pa. Built by Panellit, Inc. Engineered by Gilbert Associates, Inc., Reading, Pa.

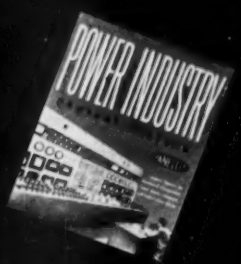
putting imagination to the rule . . .

Practical, new ideas in control systems are making the operation of power generating stations and sub-stations easier . . . better . . . more economical . . . and more dependable today.

Many recent, outstanding installations in the power field have been built by PANELLIT . . . and reflect the *imaginative engineering* of the PANELLIT organization.

PANELLIT builds only control systems and panelboards. It does not manufacture instruments or controls, thus its engineering assistance and equipment recommendations are always independent of sales considerations.

PANELLIT maintains a separate Power Division in its Engineering Department, as well as divisions for other specialized fields of application. It is this complete understanding of our business and your application that has enabled PANELLIT to establish new standards in power and process industry instrumentation.



NEW LITERATURE entitled "POWER INDUSTRY CONTROL SYSTEMS" will gladly be sent to you upon request. Ask for Bulletin 3010.

PANELLIT

. . . engineers and builders of control systems, panelboards and Panelgraphs

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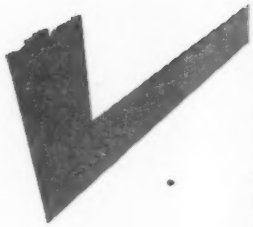
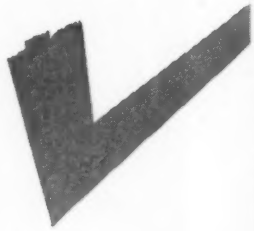


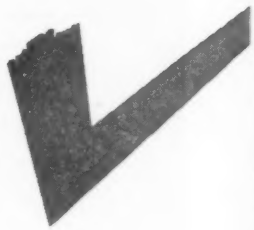
for using HAGAN

automatic combustion controls



and HAGAN

ring balance flow meters



HAGAN
HALL
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CALGON

It makes good sense to invest your dollars in Hagan Combustion Controls and Hagan Meters. The investment pays real dividends in the following ways:

accuracy

Hagan Automatic Controls and Ring Balance Meters are accurate, whether the system is simple or complex. This accuracy is reflected in savings which, during the life of the boiler, usually amount to many times the cost of the equipment.

dependability

Hagan Controls and Ring Balance Meters are dependable in their performance, year after year. Long life and low maintenance costs are inherent in all designs.

versatility

One boiler or many, one or more fuels, Hagan Controls handle the job easily. Hagan Ring Balance Flow Meters are the most versatile meters available for measuring and recording flow of liquids and gases.

Whatever your metering or combustion control problems, let Hagan Engineers help you solve them. Our experience is at your service. Write, or call us, at

HAGAN CORPORATION

HAGAN BUILDING, PITTSBURGH 30, PA.

BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
CONTROL SYSTEMS FOR AUTOMOTIVE AND
AERONAUTICAL TESTING FACILITIES

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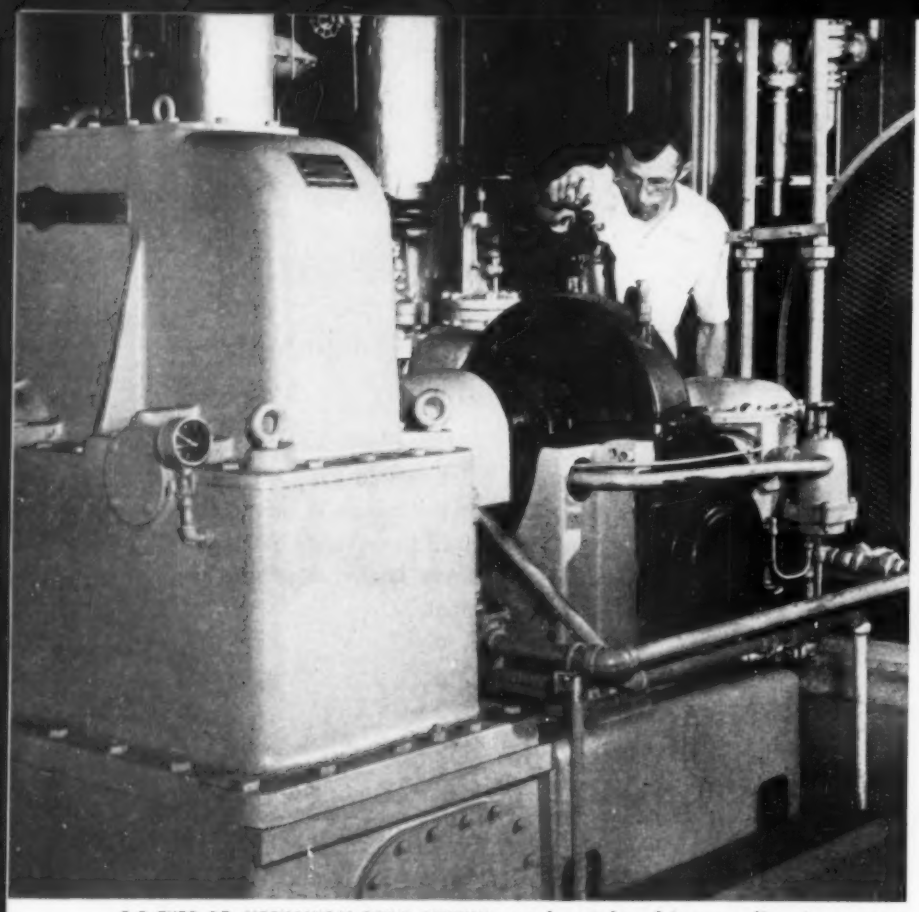
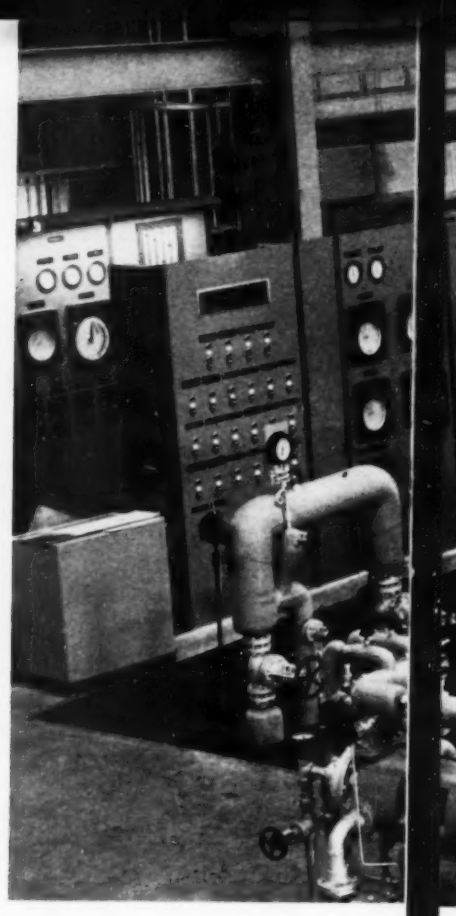
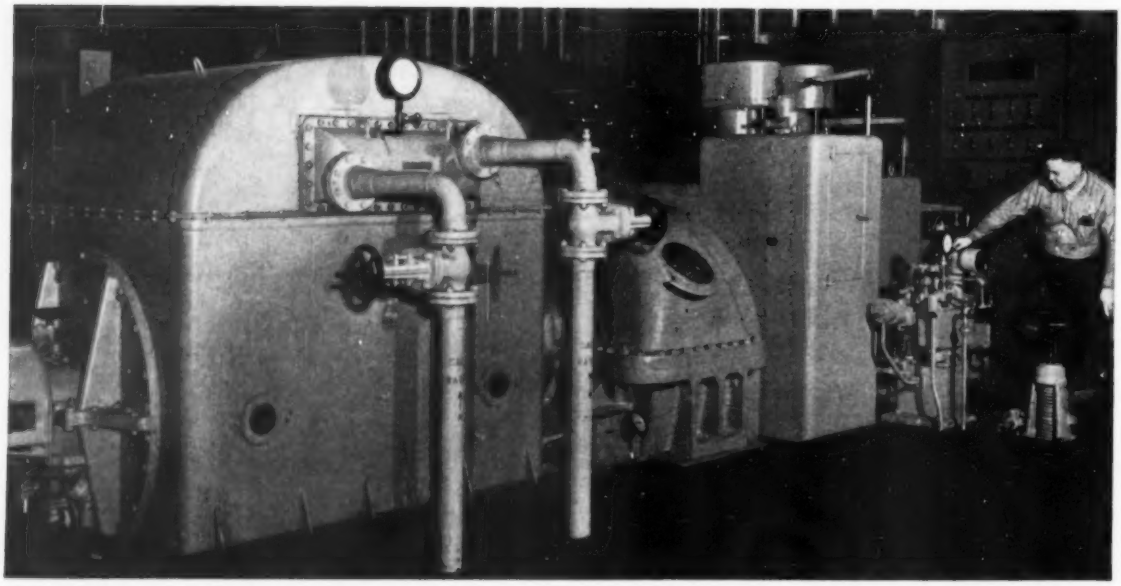


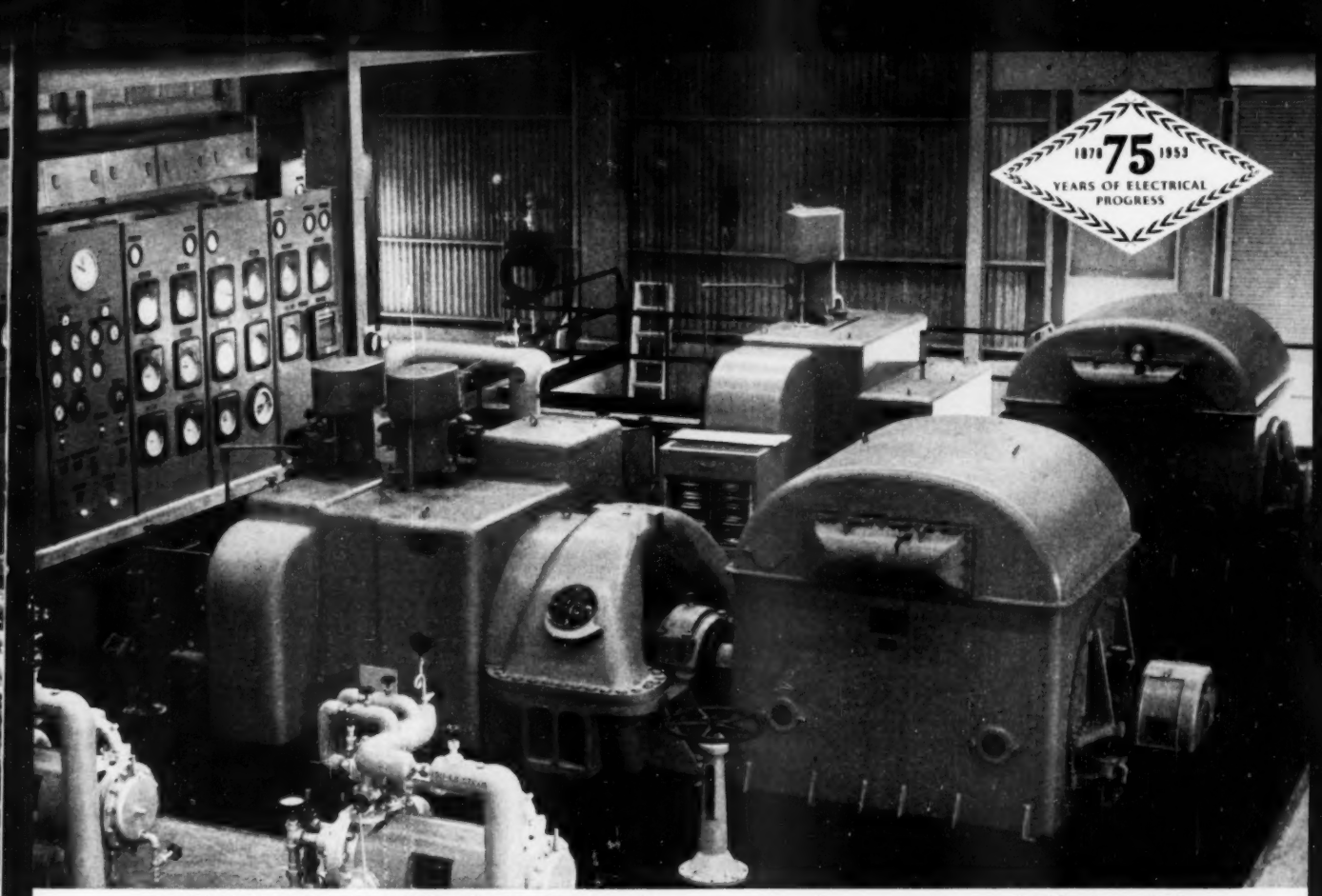


G-E TYPE DP MECHANICAL-DRIVE TURBINE, rated 135 hp, drives standby air compressors. J. A. Chamberlain, Supervisor of Utilities at Barber Refinery, checks turbine.

G-E Turbines Maintain Plant Steam



EASY STARTING of the General Electric 2000 KW double extraction turbine-generator at California's Refinery is demonstrated by W. E. Riley, Station Operator. Handwheel initiates small pilot valve, requires almost no muscle effort to operate.



DOUBLE-EXTRACTION CONDENSING TURBINE-GENERATOR in foreground supplies process steam at 150 psig and 15 psig for refinery operations at "California's" Barber, New Jersey plant. Other turbine is straight condensing.

Balance at "Calso's" Barber, N.J. Refinery

2000 KW Turbine-generators Reduce Boiler Steam to Process Pressures; Mechanical-drive Turbine with High-speed Precision Gear Drives Utility Air Compressor.

To make fullest use of available high-pressure steam, to obtain economical by-product power, and to automatically maintain plant steam balance over a wide range of steam flows, the California Refining Division of The California Oil Company selected two General Electric turbine-generators for its Number Two plant at the Barber, N. J. Refinery.

Extraction steam from one turbine-generator, a 2000 KW unit, is delivered at 150 psig and 15 psig for various process uses. Turbine governing accuracy is such that even when extraction steam or electrical load requirements vary, extraction pressures are held constant. A second 2000 KW unit exhausts to a condenser.

The "California" Refinery also installed a General Electric Type DP mechanical-drive turbine with a G-E high-speed precision gear to drive one of the compressors which furnishes utility air for use throughout the refinery. In an emergency, this turbine-driven compressor could meet complete compressed air demands.

If your plant uses process steam, why not take advantage of G.E.'s experienced turbine engineering resources. G-E engineers will study and recommend ways for you to best utilize steam supply. Get more for your turbine dollar with G-E turbine-generators. General Electric, Schenectady 5, N. Y.

256-5

You can put your confidence in—

GENERAL ELECTRIC

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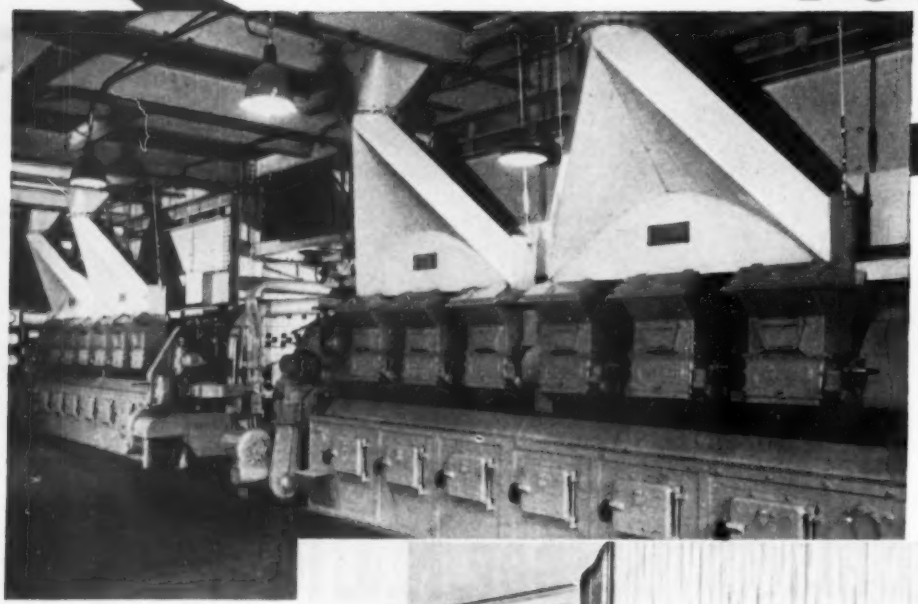
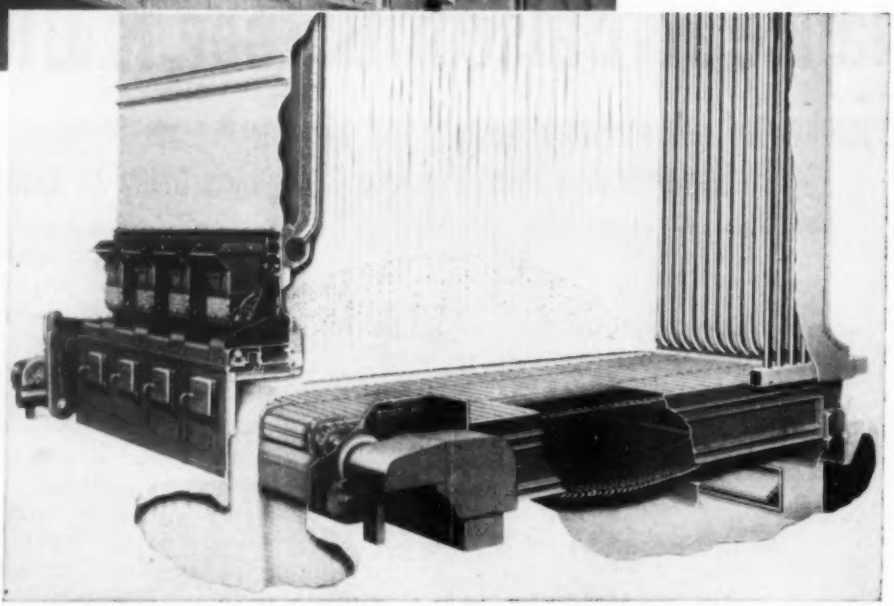
Detroit Rotograte Has You Need



Typical installation of Detroit RotoGrate Stokers in prominent Midwestern Plant. Units designed for capacities of 150,000 pounds of steam per hour each.



Cut-away view of a typical water cooled furnace of a steam generator. Two feeders are removed to show the specially designed overlapping grate that moves slowly forward to continuously discharge the ash at the front. A scientifically designed reinjection system provides effective furnace turbulence.

Detroit RotoGrate Stokers may be applied to all types and makes of boilers or steam generators, and are available for capacities up to 400,000 pounds of steam per hour per unit.

DETROIT STOKER COMPANY

GENERAL MOTORS BUILDING • DETROIT 2, MICHIGAN

Works at Monroe, Michigan • District Offices in Principal Cities

The Features in a Stoker:

- Burns any Bituminous coal or Lignite.
- Requires no special fuel preparation.
- Exceptional fuel economy.
- Low auxiliary power.
- Increased capacities due to higher burning rates.
- Responsive to fluctuating loads.
- Continuous ash discharge eliminates intermittent cleaning.
- Coal feed, air supply and ash discharge are automatically controlled.
- Air for combustion may be preheated.
- Availability high—Maintenance low.

Hundreds of such RotoGrate installations have been made since first introduced by us in 1938. Repeat order customers are best evidence of satisfactory performance.

Do you need more steam? If so, investigate and order your Detroit Stokers now. Whether you are an old or new customer, we are at your service. Write for catalog.

There is a type and size of Detroit Stoker for every Industrial or Commercial need.

DETROIT ROTOGRATE STOKER

REPRESENTATIVE INDUSTRIAL ROTOGRATE USERS

- *Abitibi Power & Paper Co., Ltd.
- *Allied Chemical & Dye Corp.
- *Amalgamated Sugar Co.
- *American Crystal Sugar Co.
- American Cyanamid Co.
- American Distilling Co.
- American Steel Foundries
- Campbell Soup Co.
- Capital City Products Co.
- Carborundum Co.
- *J. I. Case Co.
- Certain-teed Products Corp.
- Chesapeake & Ohio Railway Co.
- Chicago & Northwestern Railway Co.
- *Chrysler Corp.
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*Repeat Order Plants

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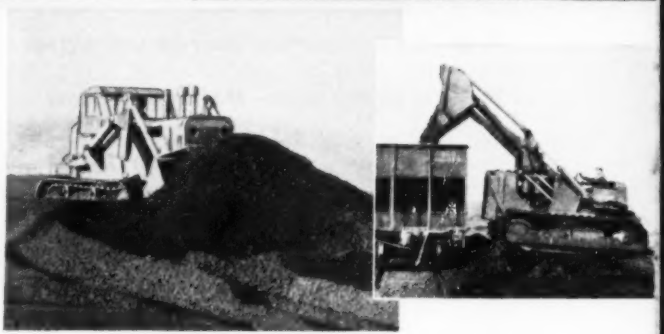
New Trends in Coal Handling

Store Coal 30 Tons at a Time. These two Allis-Chalmers HD-20 Torque Converter Tractors together move 30 to 36 tons of coal at a pass — dozing it out onto a stockpile at a southern power plant and compacting it at the same time to avoid fire by spontaneous combustion. Working as a team, the 41,000-lb. tractors move 15 to 30 percent more coal at a pass than they could both move separately. Two Allis-Chalmers units purchased in 1950 operated so successfully that the utility now has eight working at three plants.



Tractor-Scraper Team Stockpiles Coal Anywhere. Coal brought in by water to Midwest chemical plant is economically hauled to stockpile, spread in 4-in. layers and compacted by Allis-Chalmers HD-20 Torque Converter Tractor and 25-yd. (18-ton) scraper. With tractor-scraper units that travel anywhere, storage areas can be placed wherever space is available, coal piled high if space is limited.

World's Largest Tractor-Shovel Pushes Coal or Loads It. *Above left,* Allis-Chalmers HD-20G with 7-yd. bucket is a big-production unit for moving coal to stockpile and then reclaiming it as needed. *Above right,* the HD-20G is a big-production loader, too. Its 5-ton capacity and 13-ft. dumping height make it ideal for loading hoppers, cars, biggest trucks.

New Special Coal-Handling Blade for HD-20 Torque Converter Tractor is designed to take full advantage of the tractor's big 175 net engine hp., permitting it to move about 15 percent more coal than with regular blade. The unit shown here stockpiling coal for a New York utility moves an average of 14 tons at a pass.

Motor Scrapers Move Coal Fast on Longer Hauls. With 4th-gear speed of 22.5 mph. and heaped capacity of 18 yd. (13½ tons), the Allis-Chalmers TS-300 Motor Scraper efficiently moves big quantities of coal long distances. It compacts well, too, with 47,900 lb. total weight. Has 20 hp. per cu. yd. capacity for bigger loads every trip. The TS-200 Motor Scraper has a heaped capacity of 13 yd. (10 tons).

Flexibility in Tractor Handling of Coal is shown by versatile Allis-Chalmers units. They can either handle all storing and reclaiming of coal—or supplement existing facilities. Storage areas can be added without installing costly conveyors, tracks, etc.—or abandoned without leaving money tied up in idle equipment. The 109-drawbar-hp., 27,850-lb. HD-15 Tractor seen here easily takes care of all storing and reclaiming of coal for an eastern power plant.

HD-9 Tractor Handles Coke for Steel Mill. An Allis-Chalmers 72-drawbar-hp., 18,800-lb. HD-9 Tractor dozes coke out onto stockpile, levels and compacts it, then reclaims it as needed by the plant. Freezing of coke surface in wintertime no longer hinders operation with tractors as it did with previous system.

cuts equipment investment, speeds work with versatile HD-5G Tractor-Shovel

Stockpiles. Allis-Chalmers 40-drawbar-hp. HD-5G Tractor-Shovel pushes coal wherever desired on stockpile at Midwest plant. Also stockpiles cinders.

Compacts. With added weight of full loaded bucket, 16,200-lb. HD-5G compacts coal for safety from fire.

Reclaims, Loads. With 2-yd. (1½-ton) bucket and 9-ft. dumping height, the HD-5G efficiently loads coal from stockpile to trucks for hauling to plant. Dozes or carries coal on short hauls. Owner supplies cinders to concrete contractors, finds handling them with HD-5G faster and lower cost than the power shovel formerly used for this purpose.

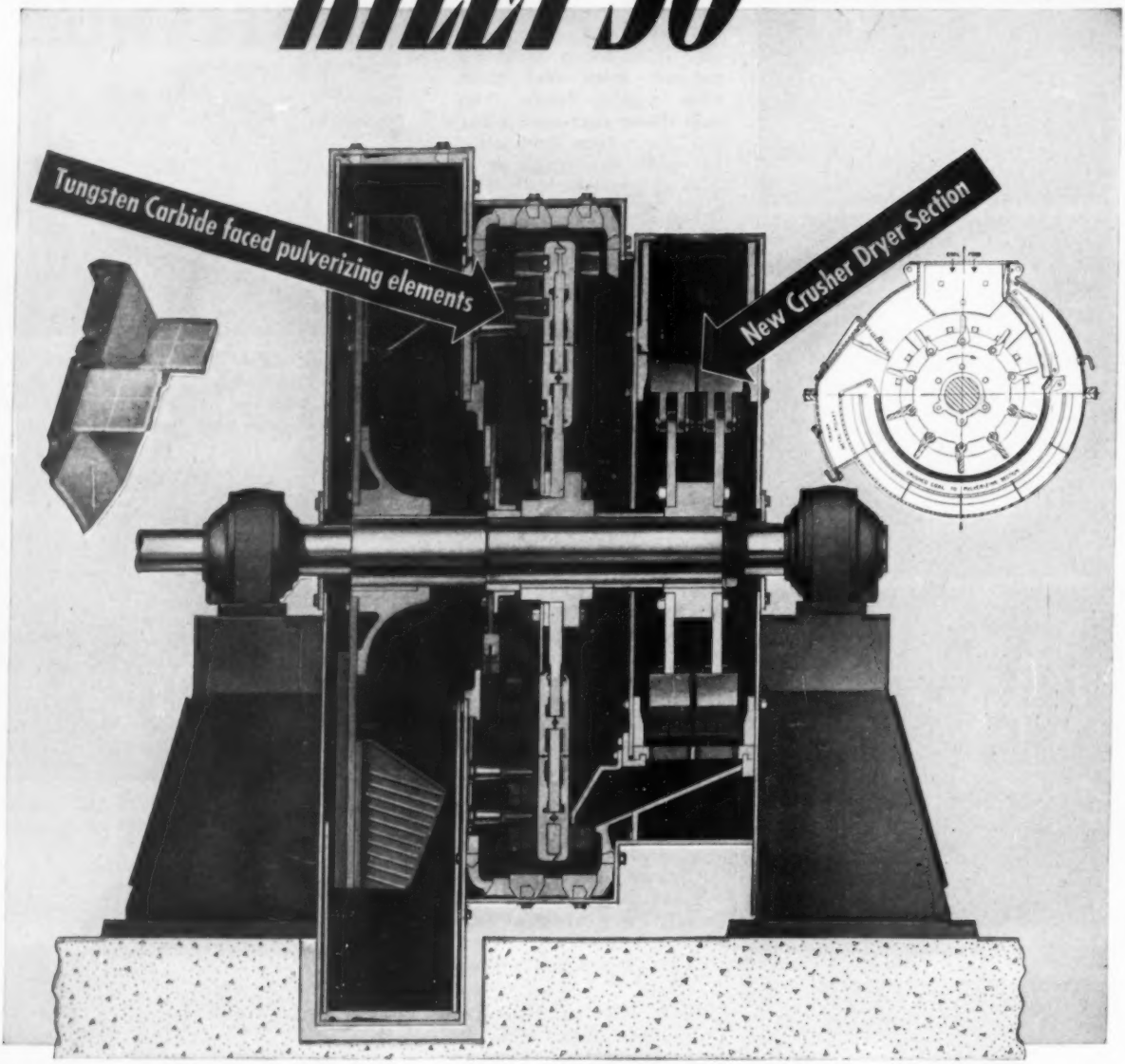
ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

4 TRACTORS • 4 TRACTOR-SHOVELS • 7 SCRAPERS • 2 MOTOR SCRAPERS
2 MOTOR WAGONS • 5 MOTOR GRADERS

Find out more about how Allis-Chalmers equipment can improve coal handling for you. See your Allis-Chalmers dealer for a demonstration right at your plant. Also, send for free booklet, "Economic Coal Storage with Allis-Chalmers Tractors."

For more data circle 518 on Post Card

The New "RILEY 50" Pulverizer



Pulverizing elements of the New Riley "50" Pulverizer are faced with tungsten carbide, assuring years of continuous service, low maintenance and sustained fineness without adjustments. The crusher-dryer section evaporates surface moisture so that moisture content of coal does not affect capacity. Foreign materials are also rejected in this section and coal is crushed to fine granular state, without damage to pulverizer.

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Pittsburgh Cleveland Detroit Chicago
Cincinnati Charlotte Atlanta New Orleans St. Louis Kansas City St. Paul Tulsa Houston
Denver Salt Lake City Los Angeles Portland Seattle

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • ECONOMIZERS

Spontaneously Accepted by Engineers

Because of These Outstanding Features

1 No capacity reduction with increase in moisture.

2 Tramp iron, iron pyrites and other foreign materials in coal rejected.

3 Pulverizing elements faced with tungsten carbide.

4 Fineness sustained over years of operation.

5 Long periods of operation without necessity of shutdowns.

6 Unusually high capacity per unit of space.

7 Minimum foundation requirements.

8 Ability to carry low loads.

9 Flexibility-wide load range.

10 Operates without coal, with no noise and without wear or damage to parts.

11 Low maintenance and power.

12 No explosion hazard, travel of coal through pulverizer faster than flame propagation.

13 Quiet vibrationless operation.

14 Ease of lighting and regulation.

15 High primary air temperatures.

16 Thoroughly dependable.

17 Negligible cost of lubrication.

18 All moving parts on a single horizontal shaft with bearings outside of housing. No worms or gears.

19 Primary air fan integral with pulverizer —separate fan and motor not required.

All of these people have ordered Riley "50" Pulverizers within the past two years

PUBLIC UTILITIES

Detroit Edison Co.
Iowa-Illinois Gas & Electric Co.
Monongahela Power Co.
Utah Power & Light Co.
Hartford Electric Light Co.
Public Service Co. of Colorado
Iowa Electric Light & Power Co.
Northern States Power Co.
The Potomac Edison Co.
Superior Water, Light & Power Co.
Western Colorado Power Co.
South Carolina Public Service Authority
Corn Belt Power Cooperative
Central Ohio Light & Power Co.

MUNICIPAL PLANTS

City of Richmond, Indiana
City of Holyoke, Mass.
City of Rochester, Minn.
City of Owensboro, Ky.
City of Austin, Minn.

INDUSTRIAL COMPANIES

Carbide & Carbon Chemical Co.
Goodyear Tire & Rubber Co.
Western Electric Co.
General Electric Co.
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North American Aviation
The Ohio Oil Co.
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Continental Can Co.
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St. Croix Paper Co.
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A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

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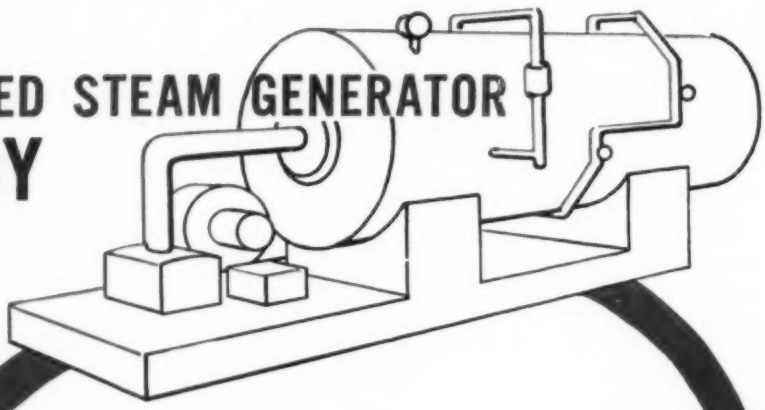
Ideal Combination

FOR TOP SELF-CONTAINED STEAM GENERATOR EFFICIENCY



1

Nalco WATER TREATMENT
SCALE AND CORROSION PREVENTION

With a Nalco Service Policy and Nalco Chemicals to fit your water treatment requirements, you can keep your self-contained boilers operating indefinitely at top efficiency — without any of the costly difficulties caused by scale and corrosion. This part of the Nalco System was designed expressly to provide small boiler users with the same complete water treatment services enjoyed by thousands of the country's largest power plants. A new 4-page bulletin gives complete details on The Nalco System as applied to the modern self-contained boiler. Your copy will be sent promptly, without obligation.

Write for Bulletin 49

2

Nalco SR-155 FUEL OIL ADDITIVE
FUEL SAVING... CLEAN BURNERS

Nalco SR-155 is a *complete* fuel oil additive. It replaces two, three or more single-purpose additives to: (1) keep storage tanks, fuel lines and burners free of sludge and gum; (2) prevent soot formation in the firebox and flues; (3) inhibit corrosion throughout the fuel system; and (4) act as a combustion catalyst to assure complete burning of oil. Fuel savings and reduced maintenance costs usually more than repay the cost of continuous SR-155 treatment — and very little SR-155 is needed per 1,000 gallons of fuel oil! Details on Nalco SR-155 will be sent on request.

Write for Bulletin 46

NATIONAL ALUMINATE CORPORATION
6222 West 66th Place • Chicago 38, Illinois
Canadian inquiries should be addressed to Alchem Limited, Burlington, Ontario

THE *Nalco* SYSTEM • Serving Industry through Practical Applied Science

For more data circle 520 on Post Card

Helpful Bulletins

THE ANSWERS to many of your operating and maintenance problems are found in these new and recently revised catalogs and bulletins. Circle item numbers of all catalogs wanted on the postage-free card below, detach and mail

VALVES, PIPING, FITTINGS

101 Solenoid Valve Ordering Guide — Eighty-pp Catalog 24 is comprised of bulletins covering company's comprehensive line of solenoid valves and includes general information, selection tips and flow charts. Among valve types presented are two-way and three-way midget valves, super-duty four-way solenoid valves with poppet-type seats and discs, general purpose and explosion-proof solenoid valves, also strainers. Automatic Switch Co.

102 Pressure Reducing Valve — An automatic pressure reducing valve is described in 6-pp Form 100. Illustrates and discusses design features, gives dimensions and weights, also materials of construction. Tells how this sliding gate valve affords pressure regulation for steam, water, oil, gas and air; includes flow tables. Jordan Regulator Corp.

103 Anhydrous Ammonia Valves — Sixteen-pp Catalog 801 introduces a series of newly designed valves for applications where ammonia and other gases, non-corrosive to steel, are used. Presents a wide range of valves and fittings, describing their special features and applications. Includes sizes, also prices of fittings and many of the valves. Henry Valve Co.

104 Test Data on Insulated Pipe — This 6-pp engineering test report covers simulated operating tests made on insulated pipe. Gives methods, temperature recording and results of tests to determine temperatures developed in and near conduit buried 48 in. underground, and effects of water and high temperature on casing. Durant Insulated Pipe Co.

105 Synthetic Hard Rubber Pipe, Fittings — Tempron, a heat- and chemical-resistant synthetic hard rubber compound is described in Bulletin 96-A. Cites advantages of this material for pipe and fittings, gives dimensions of piping, and fittings available. Includes data on physical and electrical properties of Tempron and lists chemical solutions it can handle. The American Hard Rubber Co.

106 Tube Fittings — Sixteen-pp Catalog 253 illustrates and provides sizes and prices for more than 90 items, including brass shut-off valves, flare tube fittings, compression fittings, brass pipe fittings and others. Drawings show thread standards. Universal Brass Corp.

107 Flexible Metal Hose — This bulletin emphasizes the wide range of hose types and assemblies available from this manufacturer. Pictures some common flexible hose installations, and includes a handy application chart showing type of assembly to use for handling various kinds of liquids, gases, solids and semi-solids. Flexonics Corp.

108 Sealer for Joints — Bulletin B7A describes a plastic sealing compound for stopping spiral leakage in threaded joints. Explains how this leakage occurs and how company's Graycote acts to stop it. Gives features of the sealer and suggested applications. Chicago Gasket Co.

PUMPS, PUMPING

109 Centrifugal Pumps — Single-stage, double-suction centrifugal pumps are described in newly revised 24-pp Bulletin 08B6146B. These pumps, in 66 standard sizes, individually engineered to customer specifications, are used for general water supply, circulating, gathering, drainage and other applications in water utilities, power plants and many industries. Besides providing data on pumps' construction features, bulletin tells how to figure pumping head, carries tables of sizes, head capacities, friction loss. Allis-Chalmers Mfg. Co.

110 Rotary Pumps — Catalog 953, 8 pp, describes briefly a line of rotary pumps for manufacturing, process, petroleum and other applications. Explains principle of operation incorporated in these pumps. Includes sizes, capacities, suggestions on selection. Geo. D. Roper Corp.

111 Vacuum Pumps — Bulletin 270, 20 pp, is a recent printing of company's booklet on Condo-Vac return line vacuum and boiler pumps for vacuum heating systems and industrial services. Discusses general features of this line of pumps, explains Condo-Vac principle and its relation to economical operation. Various types of Condo-Vacs are described in detail, dimensions given. Chicago Pump Co.

112 Multi-Stage Pumps — Two-, three-, four-, and five-stage pumps for supplying, circulating and boosting water and process liquids are described in Bulletin B-1400, 12 pp. Illustrated in color, includes pump cross sections, application photos. Discusses general features of the line, design and construction features of these split-case type pumps, provides dimensional data. Peerless Pump Div., Food Machinery and Chemical Corp.

MECHANICAL POWER TRANSMISSION

113 Shaft Seals — Form 455, 12 pp, presents a mechanical seal that rotates with the shaft and is designed to meet sealing needs of centrifugal and rotary pumps, agitators, blowers, other rotating equipment. Explains advantages of these seals, gives suggested uses for six types, also for a double seal and a cartridge sleeve seal. Cutaway drawings show design details. Durametallic Corp.

114 Riveted Roller Chain — Riveted chain as easily coupled as cottered chain is described in detail in Bulletin 52-2. A highlight of this 24-pp booklet is a graphic section showing how the chain is made up to any length. Features of the chain are illustrated. Assembly diagrams and charts for all size chains are presented, as well as list prices and boxed assembly specifications. Also includes data on stand-

MAY, 1953

Card void in 6 months

POWER ENGINEERING

Please have the manufacturers send me without obligation information or bulletins indicated by the numbers circled below.

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Company Name.....

Company Address.....

City.....State.....

(If you prefer delivery at home, give home address, too)

Home Address.....

City.....State.....

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ard roller chain available. Baldwin-Duckworth Div., Chain Belt Co.

115 Herringbone Gear Speed Reducers — Informative engineering data on continuous tooth herringbone gear speed reducers is given in 58-pp Catalog 40-C. Gives general specifications of the line, and selection suggestions; stresses design advantages. Detailed information is presented on parallel shaft, offset drive, single-, double- and triple-reduction units of 2-to-1 to 370-to-1 ratios, 0.5 to 5000 hp; and straight line drive, double reduction units of 11-to-1 to 76.5-to-1 ratios, 0.8 to 800 hp. D. O. James Gear Mfg. Co.

ELECTRICAL

116 For Modern Power Distribution — Bus duct application to distribution systems of industrial, institutional and other buildings is described in 12-pp Booklet B-5835. Four types of bus duct are presented: plug-in duct, low-impedance duct for long feeder runs or where minimum voltage drop is important, weatherproof feeder duct for outdoor installations, and weatherproof low-impedance duct. Photos and application data from actual installations show how bus duct solves distribution problems connected with modernization, expansion, or new building programs. Westinghouse Electric Corp.

117 Cables for Direct Burial Installations — Of special interest to users of 0 to 5000 v non-metallic sheathed power cables is Bulletin OK-1066, 12 pp. Brief and factual, it gives construction features, dimensional data and installation recommendations. Also includes current carrying capacity data. The Okonite Co.

. . . Outstanding Among This Month's Catalogs

118 Motor-Generator Reference Book — Publication 51R7933 is a 50-pp booklet compiled to assist in the selection of motive power to handle most industrial applications. Neither text book nor ordering catalog, this book provides a brief outline of the various types of motors, generators and motor-generator sets, telling their applications and operating requirements. Booklet is generously illustrated and includes performance data, ratings, information on methods of speed control, general characteristics and representative dimensions. Much of the material presented is from a reference book published by the Electrical Modernization Bureau, Inc. Allis-Chalmers Mfg. Co.

119 Asbestos Electrical Insulations — "Quinterra-Quinorgo," 32 pp, gives information about two electrical insulations made of purified asbestos, telling why they were developed, what their characteristics are, where they may be used to advantage. Serving as both handbook and descriptive brochure, the booklet contains test data and advice on application techniques and equipment including photos of methods now in use. Johns-Manville.

120 Silicone Rubber as Insulation — The properties and processing of silicone rubber as an insulating material for wire and cable are detailed in 8-pp Bulletin CDS-13. A section on applications covers the use of the heat- and flame-resistant material for Navy and ignition cable. Chemical Div., General Electric Co.

AIR CONDITIONING AND VENTILATING

121 How Much for Air Conditioning — A quick and simple investment analysis technique for determining how much the installation of air conditioning can save through increased employee efficiency is available in a handy booklet. (Form SE79-2150.) The analysis also shows how many years it will take for the air conditioning to pay for itself. Air Conditioning Div., General Electric Co.

122 Packaged Ventilating Sets — Catalog 515, 28 pp, introduces company's V-belt Ready Units, complete ventilating sets for handling any volume of air from 100 to 12,000 fpm at low static pressures. Stresses versatility, quiet operation, efficiency, other features of the units, discusses advantages of V-belt drive, explains construction details. Includes capacity data for all sizes of the units. Clarage Fan Co.

INSTRUMENTS AND CONTROLS

123 Millivoltmeter Type Instruments — Catalog 1053, 24 pp, describes indicators, indicating electronic controllers and excess temperature safety cut-off controllers. Information on operation and applications of on-off, two-position three-position and "pulse-type" time-proportioning controllers is included as well as data on primary measuring elements, dimensions, ordering information and selection tables. Brown Instruments Div., Minneapolis-Honeywell Regulator Co.

124 Temperature, Conductivity Controllers — Complete data about moderate-priced electronic instruments for two-position or proportional control is given in 20-pp Catalog ND47. Shows how three types of temperature controllers are being used to regulate temperatures up to 1000 F. Also describes a conductivity controller for checking condensate purity. Diagrams and brief text combine to show how the temperature controllers apply various types of control. Includes specifications. Leeds & Northrup Co.

The Reader Service Card at left needs no postage. Just circle item numbers of all bulletins wanted, fill in name, company, detach and mail

125 Level Controls, Safety Devices — Ordering information and application suggestions on a line of boiler water level controls and safety devices is presented in Catalog SC-3, 24 pp. Describes and pictures boiler-water and make-up water feeders, low water fuel cut-offs, temperature and pressure relief valves, float operated switches, float valves and other equipment. Includes price list. McDonnell & Miller, Inc.

126 Instrument Gages — Bulletin 98214, 24 pp, describes recent developments in 6-in. dial indicators for temperature, pressure and load applications. Generously illustrated, gives information on features, dials and scales available, together with reference material on types of actuation. Sensitive elements for the tem-

(*Continued on page 115*)

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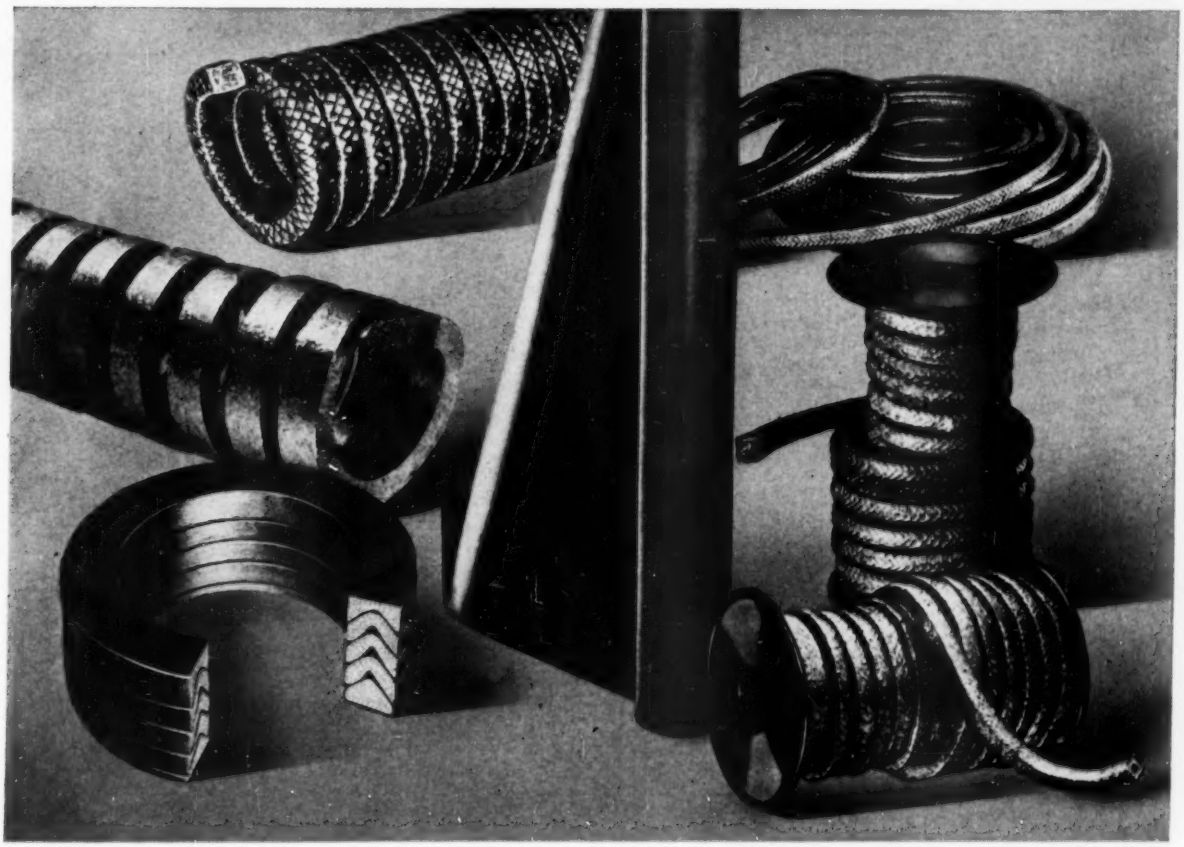

Lower inventories! Simplify ordering! Reduce downtime!

Don't labor any longer under the impression that you must carry 10, 20, 50 different types of packing. The whole idea is *obsolete* as of now! Unless you have a very rare packing application, just 3 or 4 of R/M's new "Big 7" Packing Types will probably meet every one of your requirements. Nothing less than an engineering feat—from raw materials through continuous manufacturing processes—has made this simplified approach to the packing problem possible. To accomplish it, R/M has drawn to the fullest extent on its 50 years of know-how and experience. It has utilized the research, testing and production facilities of all its seven great plants. You can count on these "Big 7" R/M Packing Types for superior performance every time. See your distributor for details. Let him show you how R/M Packings will lower your inventories, simplify your ordering, reduce your downtime.

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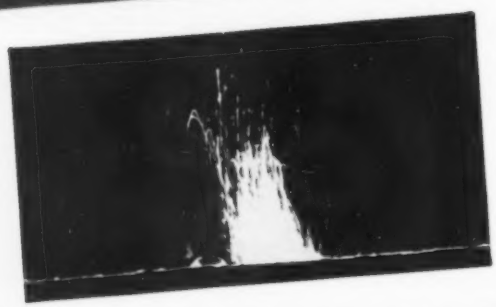
For more data circle 521 on Post Card

How Dearborn Helps

with FILMEEN for the control of return line corrosion

Dearborn's patented FILMEEN—a filming-type amine treatment—forms a continuous monomolecular film in the return line, thus effectively coating and protecting the line against both oxygen and carbon dioxide corrosion. Improves heat transfer and reduces steam costs.

Bulletin 5013-A gives complete information on FILMEEN—describes and illustrates how to reduce maintenance expense and protect valuable equipment.



with DEARBORN Formula 659

Boilers, feed lines, heaters and economizers are protected against sludge accumulations—steam purity control is assured—turbine deposits are effectively prevented—with Dearborn's Formula 659 Sludge Conditioner and Polyamide Anti-Foam Treatment. Safeguards against carry-over of suspended and dissolved solids. Protects valuable parts—avoids expensive maintenance and unnecessary shutdowns. Bulletin 5008 tells the complete story.

Dearborn

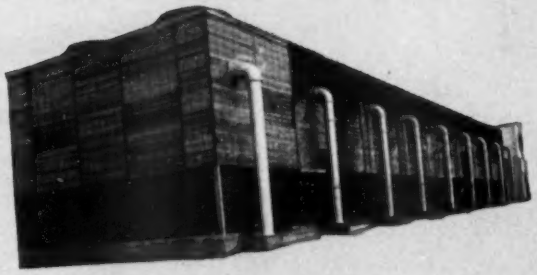
TRADE MARK

COMBATTING CORROSION EVERYWHERE SINCE 1887

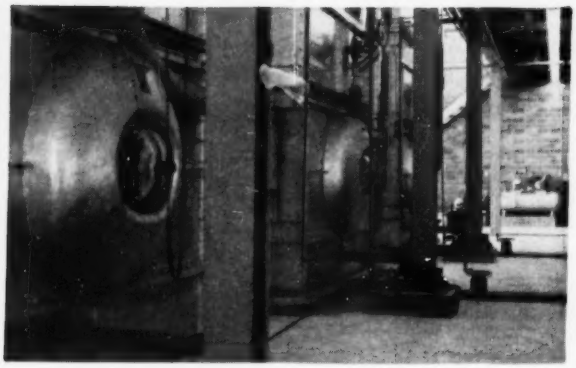
DEARBORN CHEMICAL COMPANY · Merchandise Mart Plaza, Chicago 54, Illinois

Make Water Behave!

COOLING WATER for testing jet aircraft engines is treated by DEARBORN



Here is one of the giant 500,000 gallon cooling water towers operated by the National Advisory Committee for Aeronautics. To prevent scale formation, corrosion and delignification of the wood, properly conditioned water was necessary. Dearborn engineers did the job... analyzed the raw water, and specified the correct treatment, test equipment and controls.

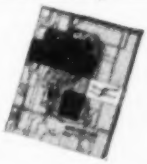


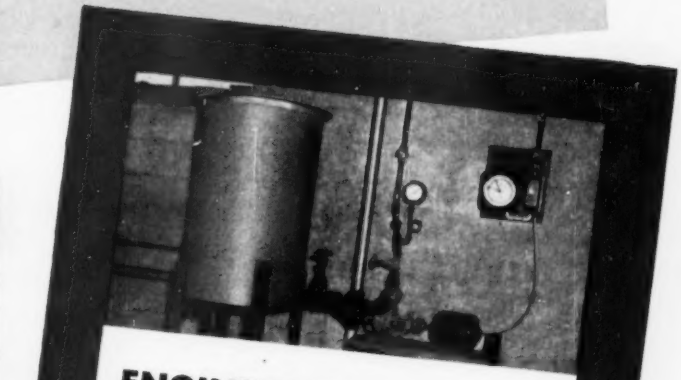
with DEARBORN'S complete water treatment and engineering service

Providing trouble-free water—a vital necessity to every user of steam—has been Dearborn's business for more than 65 years.

Today; this broad background of experience—plus treatment formulas that have been tested and re-tested and the most modern laboratory and research facilities—is available to you at Dearborn.

To keep your power and steam-producing facilities at peak production... to greatly minimize unnecessary maintenance—call your Dearborn Sales Engineer. He's our expert who will check your facilities—analyze your raw water—recommend the proper treatment, feeding equipment and test procedure. Dearborn Bulletin 5000 describes this service.





ENGINEERED equipment

For optimum water conditioning, proper equipment is essential. Here, too, Dearborn can help you. The complete line of Dearborn ion-exchange and treatment feeding equipment, plus test control facilities, will provide you with assurance of top operating efficiency.

Dearborn Chemical Company, Dept. PG
Merchandise Mart Plaza, Chicago 54, Illinois

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Company.....

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City.....*State*.....

For more data circle 522 on Post Card

This is *PRECISION*

A-C Crane Hoist Control

15 Tons of Steel . . . handled as though it weighed a pound. The picture at the right tells the story. A walnut and wrist watch were placed side by side. The operator lowered the 15-ton, full-hook load. The walnut was cracked. Then the load was raised without the least settling action. The watch was left untouched.

That's Precision . . . precision that is attained on all cranes equipped with the new Westinghouse Load-O-Matic Crane Control. In this particular test, the load was lowered with the master switch set at the first point lower. No jogging, inching or retardation was necessary—lowering rate was smooth and steady.

The Load-O-Matic hoists and lowers *all* loads—the empty hook, light or maximum loads—at stabilized speeds. Loads can be brought to a standstill or suspended by action of the motor only.

VERNIER CONTROL PROVIDES FLEXIBILITY

Additional flexibility of operation is available with the auxiliary Vernier control. This control component is especially useful for high-accuracy spotting. For example—with full load on the hook and the master switch on the first lowering point, operation of the Vernier provides control from approximately 7% of full speed to standstill. Operator can actually float the load into the desired spot.

ASK FOR DESCRIPTIVE BOOKLET B-5417

This booklet describes all the operating characteristics and features of the Load-O-Matic a-c crane hoist control. Ask your Westinghouse representative for your free copy, or write direct to: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-27015-A

YOU CAN BE SURE...IF IT'S

Westinghouse

This simple test of the Westinghouse Load-O-Matic was conducted at a Materials Handling Conference and witnessed by more than 100 engineers. The full load of 15 tons was lowered at an almost imperceptible speed till it cracked the walnut. The watch was not damaged. Then the load was raised without the least settling action.

For more data circle 523 on Post Card

Equipment News

SUMMARIZED HERE are new products and improved ones . . . recent developments of leading manufacturers who will gladly supply further information at no cost. You may use the no-obligation, postage-free cards on pages 37 and 115 for your request. Just circle the numbers of the items you'd like to know more about

1—FEED PUMP MOTOR

For power plants, comes in ratings of 1000 hp and larger

This new boiler feed pump motor features an improved ventilation system, cubical design, a special high-speed rotor and quieter operation. The unique ventilation system of the motor discharges the heated air away from workers and other nearby motors. This contributes to employee comfort, it is explained, and permits adjacent units to be mounted closer together without harmful recirculation of hot air. The air is drawn in from the motor's sides and expelled at a higher level from the shaft end of the motor over the couplings and boiler feed pump.

To blend with modern power station styling, the over-all width of the motor has been reduced. Savings in floor space can thus be realized, according to company engineers, because the motors may be mounted closer together. The rotor, designed to operate at 3600 rpm, received a special finish after grinding which aids in reducing turbulence and noise, company says, and quieter operation is further achieved by a large air discharge chamber and the baffling effect of louvered inlets and outlets. General Electric Co.

2—BUTTERFLY VALVE

For use on liquid, sludge or dry material lines

This butterfly valve is said to feature speed and ease of operation, and its design permits use of any combination of interchangeable end connections. According to manufacturer, the disc of the valve seals in a resilient, oil- and acid-resistant seat and will provide complete shut-off against pressures to 150 psi, or against vacuum. The valve is so constructed that the entire sealing section, containing seat, disc, and handle, can be removed without line disconnection.

The handle mechanism of this valve is indexed, to hold the valve in fully opened or closed position. The valve is made in sizes from 2 through 12 in., and can be supplied in a wide range of materials, in a variety of end connections. Keystone Tool Corp.

3—ASH CART

For rolling away boiler room ashes or machine shop parts

The Rol-A-Way is made of heavy steel for general industrial use. It is constructed to receive ashes direct from the average 20 in. high grate line and its use eliminates pulling the ashes onto the floor and shoveling them into a container. Its capacity is over 5 cu ft. The handle folds down for easy access to the fire door and the wheels are large for safe handling over rough floors. American Coal Burner Co.

4—PRESSURE TRAP

Is vertical, magnetic unit designed for use in slurry lines

Primarily used to protect pumps and refiners, this trap can be installed in a section of vertical down-pipe. This position takes advantage of the force of gravity which drives the flow of material containing tramp iron directly onto the magnet's face. The unit consists of a cylindrical housing, furnished by customer, with an inlet at top and an outlet at bottom. It is suggested that the cylinder be made of 24 in. dia pipe.

The trap is furnished with stainless steel angle guides welded in place. In operation, material flows directly down onto the middle of the magnet face plate, dividing in two directions to flow off the sides of the plate into the outlet pipe. Metal impurities fall by gravity and velocity into the magnetic field. The depth of flow over the magnet is restricted by the baffles to 3½ in. The trap comes in sizes for volumes from 1500 to 5000 gpm. Eriez Mfg. Co.

5—BUS RUNS

Are metal enclosed and rated as high as 8000 amp, 14.4 kv

These isolated-phase bus runs can be shipped in three-phase packages in lengths up to 16 ft. This is an extension of unit length from the previous limit of 10 ft, company states, and of rating from a previous 6000 amp, accomplished by using aluminum conductors instead of the heavy copper conductors formerly used. Electrical joints between aluminum conductor sections are silver surfaced by a plating process to assure a bond between the silver and aluminum. General Electric Co.

6—PROPORTIONING PUMP

Controlled capacity; can be used in single or multiple combinations

This controlled capacity pump is constructed to allow removal of moving parts through the crosshead without breaking piping connections. The packing gland is open at both ends to simplify replacement of packing and assure even take-up on the packing. The grease lantern ring is readily changed to a water seal for handling suspended solids or corrosives.

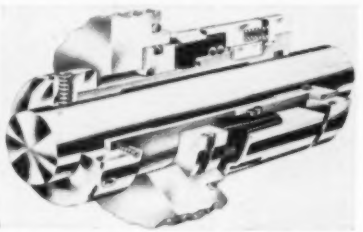
A low-capacity high-pressure reciprocating plunger pump, this proportioning unit is designed for use wherever controlled capacities of fluids are required, as in boiler water treatment, plant service and municipal water treatment, treatment of industrial wastes, chemical processing.

Minimum capacity of smallest size is 5 cc per hour, and maximum capacity of largest size is 128 gph. Pressure ranges to 20,000 psi. The pumps are supplied as complete units ready for installation and include pump and standard motor and gear reducer mounted on base plate. Philadelphia Pump and Machinery Co.

7—MECHANICAL SEAL

Balanced, heavy-duty type, designed for pressures up to 1000 psi

The Type 8-B Shaft Seal is a heavy-duty mechanical seal for applications where ruggedness to withstand high pressures is a factor. A packaged unit, this seal is furnished pre-assembled on a sleeve for ready installation. When used with



split case pumps it is not necessary to lift the upper half of the casing to install or remove the seal, company says. Its compact design adapts it for use in conventional pump stuffing boxes.

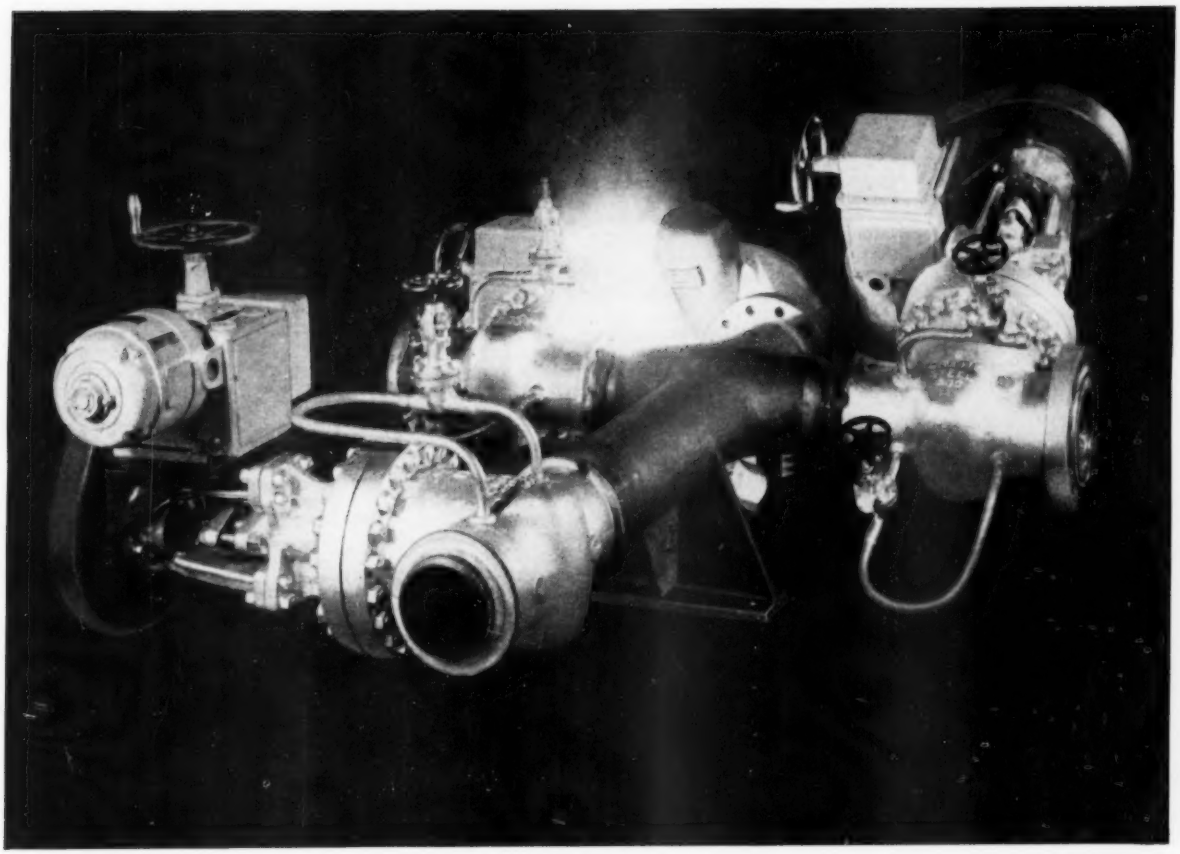
Incorporating a rotating sealing washer and "floating" stationary set, balance is accomplished by lowering the washer face to a point where stuffing box pressure is not exerted against sealing area. The rotating assembly, consisting of a retainer driven by the sleeve with washer driven from dents in the retainer, is held in contact with the lapped face of the seat by multiple springs equally spaced around the sleeve at the back of retainer. O rings provide sealing between sleeve and shaft and between washer and sleeve. Another O ring is used between stationary seat and end plate. The Crane Packing Co.

8—ROLLER CHAIN

Is easily assembled riveted type, with single pin coupler

A step in the direction of solving the problem of machine down-time due to chain failure is announced in the form of a chain combining the long-wearing characteristics of riveted roller chain and easy assembly of cottered chain.

Basically, this chain is supplied in ASA standard and heavy series, 1 in. through 2½ in. pitch sizes in multiple



What's CRANE cooking up here?

'Big Piping Savings for You—

The man behind the mask above is a *unit fabrication* specialist with a talent for saving you time, trouble—and dollars—in the long run.

He's part of a crew of experienced mechanics in one of the big Crane Fabricating Shops, where piping units like this 8-inch assembly are built *precisely* to specification.

And it's a complete as well as a quality service, for Crane takes over at the blueprint stage; supplies all valves and component parts—makes the pipe bends—does the welding. Right at hand are the best facilities for heat-treating or stress-relieving, radiography, etc., to assure uniform strength and dependability. The finished unit is pre-tested and proved in advance, ready for quick installation in your piping system.

You take no risk—you pay for no spoilages, and your erection crew is spared many a major headache. But, why not let your Crane Representative review your piping layout and help you decide where Crane Unit Fabrication will be to your advantage? There's also further information in your Crane 53 Catalog —or write for Folder AD-1771.

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois

Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

For more data circle 524 on Post Card

widths. It is made up in 10 ft lengths of riveted chain, having a specially designed single pin coupler installed at convenient intervals. Spacing of couplers varies, depending on chain size, but they are placed in the assembled chain so any length can be made without cutting rivets or damaging parts. In the Baldwin-Rex Single Pin Coupler Link incorporated in this chain a single pin, easily removed disconnects the chain. Center links or spacer plates cannot move or fall out when connecting the chain, manufacturer points out.

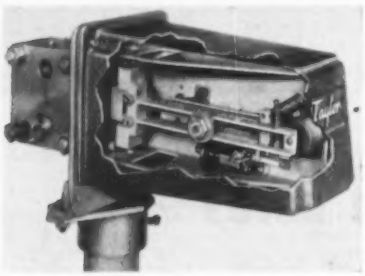
Each 10-ft section of chain is boxed individually, and any even pitch length of chain from 2 pitches to 10 ft can be made from one box of chain. Odd pitch lengths can be obtained by using a 3-pitch riveted offset section. Lengths of more than 10 ft can be made by combining additional 10-ft sections. Baldwin-Duckworth Div., Chain Belt Co.

9—TRANSMITTER

Force-balance type, is designed to simplify flow measurement

The Transaire Transmitter is offered as a solution to the problem of close-coupled fluid flow measurement, liquid level or other installation requiring differential pressure measurement and transmission. The instrument is a force-balance transmitter for converting differential pressure into an equivalent 3 to 15 psi output.

The instrument has two basic units. The primary unit senses differential pressure and consists of a two-part



steel housing enclosing a Teflon-coated, glass-fabric diaphragm. The inner housing of this unit is shaped to the contour of the diaphragm to permit full over-range protection of 1500 psi to either side of the diaphragm. The secondary unit transmits the proportional output air pressure and incorporates a pneumatic force-balance transmitting system. The unit is enclosed by a gasketed cast-aluminum cover, self-purged to keep out dust and corrosive vapors.

Inherent features claimed for the transmitter include simplified installation, easy maintenance, simple adjustments and true average damping. Full details are given in Bulletin 98226. Taylor Instrument Companies.

10—STEEL TAPES

Chrome plated, are being offered in four lengths, at popular prices

The chrome plating on these tapes creates a blue-white background which contrasts with the tape markings to improve their legibility. The plating is also said to give the advantages inherent in a tough and practically permanent surface. Tapes are available with loop handle or retractable hook handle.

Called the Redhead line, these tapes come in knurled-band steel cases covered with maroon leatherette. They have flush-folding push-button handles and precision cast winding drums, are furnished complete with translucent plastic carrying case. The line includes a range of 25-, 50-, 75- and 100-ft tapes; feet in inches and eighths or in tenths and hundredths. A 50-ft tape retails for about $4.50. Justus Roe & Sons, Inc.

11—D-C AMMETER SHUNTS

Are designed for use with 50 mv meter instruments

Sizes of these ammeter shunts range from 150 to 10,000 amp. Manufacturer says they are calibrated to within ½ to 1 per cent accuracy and complete with 10 ft calibrated leads. Each shunt is designed to maintain its accuracy at 100 per cent overload to make it applicable for use at twice the rated capacity with 100 mv instruments. All units are made with solid copper ends and solid manganum rods between copper.

Because of the heavy duty construction and low temperature coefficient of the metal alloy, accuracy is maintained when used at maximum capacity and at ambient temperature to 350 F, company says. It is also stated that force fitting of over ½ in. of manganum rod into both metals has produced an instrument that is impervious to shock and resists parting force many times its ampere rating in pounds. This development is credited with reducing cost of high quality shunts. Rapid Electric Co.

12—TANK CONTROLS

Are designed to simplify the problem of liquid level control

Introduced as a new approach to the task of controlling levels in tanks, vats or other vessels this new control utilizes three standardized components: an electrode holder, a relay, and a direct operated solenoid valve.

In operation, two stationary electrodes are suspended in the tank where a circuit between them is established or broken by the rising or falling of the liquid level. This circuit actuates the relay which, in turn, operates the solenoid valve. This valve may be installed in either the tank supply or discharge line, whichever operating conditions require for proper level control. Components are available in several sizes. Johnson Corp.

13—SAMPLE COOLER

Is designed to permit steam or boiler water measurements

The Model SC-7A-B-W Sample Cooling Coil consists of a cupro-nickel concentric coiled tubing, stainless steel connecting blocks, an industrial-type dial thermometer and bracket for wall mounting. It allows checking of high pressure steam or boiler water by means of an electrolytic conductivity cell. The sample to be tested is reduced in temperature and pressure to measuring range so that standard type conductivity cells can be used. The dial-type thermometer, located at the conductivity cell end of the coil, indicates measurement temperature. Industrial Instruments, Inc.

Use post cards on pages 37 and 115 for more information on any of these products

14—IMPROVED EXHAUST HEAD

To clean up steam and vapor discharged from industrial stacks

This new exhaust head is said to clean up exhaust vapor so effectively that no nuisance particles such as oil and process liquors are vented to attack machinery or buildings or create a public nuisance. The unit has no moving parts or filters, and according to company, is virtually maintenance free.

Entrainment laden vapor entering the purifier is engaged by a stationary centrifugal element which imparts a controlled but rapid rotational motion to the vapor. This action guides dirt particles, guck, oil and water outward to the walls of the purifier. From here it is drained and ejected, while the clean, dry steam continues upward and is discharged to the atmosphere.

Although fabricated to specification, standard models have a slip-on flange connection for the stack and a threaded connection for the drain, a fabricated steel body and stainless steel centrifugal element. The V. D. Anderson Co.

15—DRAWOUT SWITCHGEAR

Low voltage, incorporates new type of air circuit breakers

A newly announced line of low-voltage drawout switchgear (600 v a-c and below) features standardized compartment design. Complete equipments having whatever circuit pattern is needed can be manufactured from standardized circuit breaker, control-instrument and bus compartment building blocks.

Able to withstand 30-cycle momentary currents equal to their interrupting ratings (15,000 to 100,000 amp), the new circuit breakers used are said to make it possible for the first time to have fully selective tripping with all breakers applied up to their full interrupting ratings. Continuous current ratings range from 15 to 4000 amp.

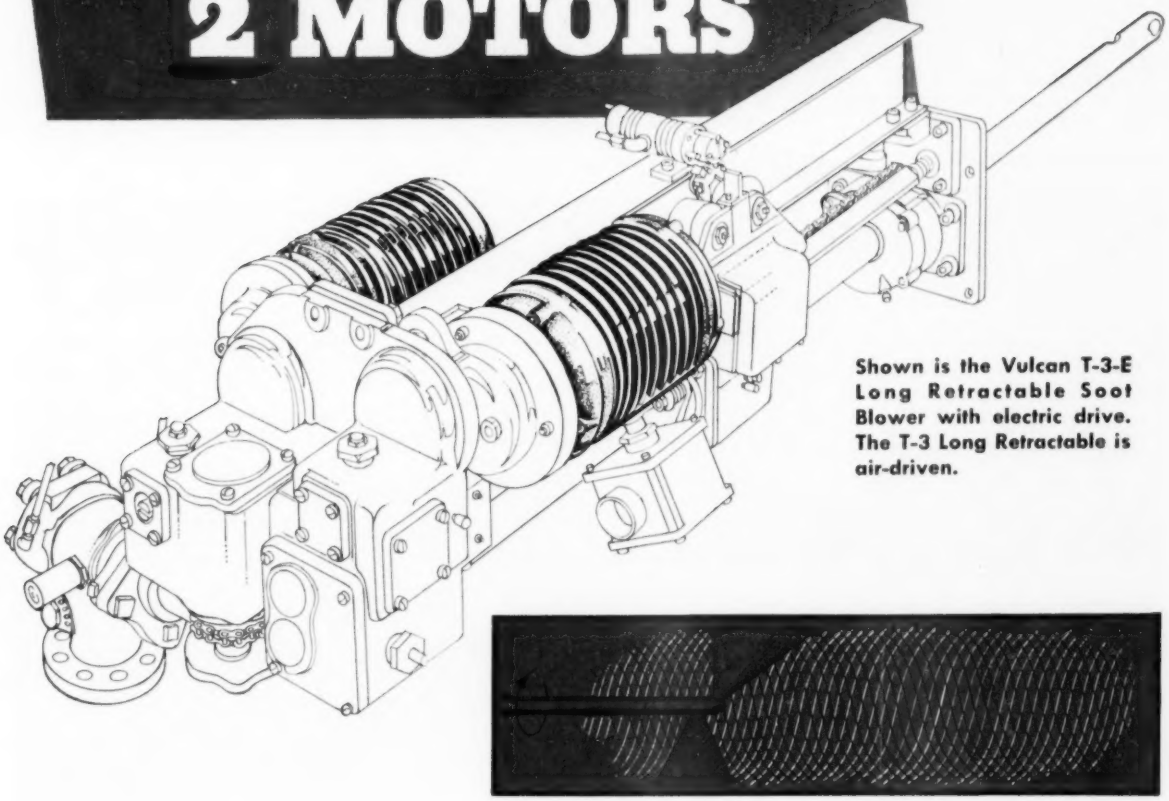
An important feature announced for the new breakers is the stored energy closing mechanism used for electrical operation of 50, 75 and 100 kva interrupting rated breakers. Earlier breaker designs depended on maintenance of control power during the entire closing operation to drive a motor or solenoid, company points out, but the new mechanism assures closing and latching against full rated short circuit current even though control voltage is lost when the breaker contacts first touch. This is accomplished by energy stored in a spring before the closing operation is begun. General Electric Co.

16—LIQUID LEVEL CONTROL

Electronic type, for a wide range of industrial applications

Based on the capacitive action of liquid surrounding a porcelain-enamel-covered electrode, the Belmont Level Control provides adjustment of liquid level and cut-in, cut-out differential over wide limits. In operation, the new unit consists of a probe, mounted directly at the location of the controlled liquid; a con-

why VULCAN uses 2 MOTORS



Shown is the Vulcan T-3-E Long Retractable Soot Blower with electric drive. The T-3 Long Retractable is air-driven.

THIS CLEANING PATTERN—an infinite number of double-helix paths—makes the second motor of a Vulcan Long Retractable Soot Blower a most profitable investment. Two motors cost more—but they are worth more.

To get such thorough cleaning—with the blowing steam or air always cleaning a new path—you must have two motors. One motor moves the lance in and out—the other rotates it. And with the two motors, traversing and rotating speeds are independently adjustable for your exact needs.

This double-helix pattern cuts tube replacement costs. There is no danger of the blowing medium constantly striking—and wearing away—the same part of each tube. Packing life is increased.

These are reasons why Vulcan "Long Retracts" are found on so many new high-duty boilers. Users know Vulcans pay for themselves quickly and often. The story is told in Bulletin 1002. Write for it.

COPES-VULCAN DIVISION
CONTINENTAL FOUNDRY & MACHINE COMPANY
ERIE 4, PENNSYLVANIA

VULCAN Automatic Soot BLOWERS

For more data circle 525 on Post Card

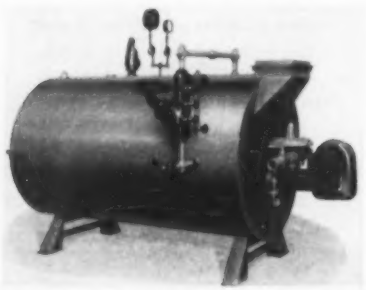
necting cable which can be up to 1000 ft long; and the control unit located for operating convenience. The two main controls (liquid level and differential) are designed for screwdriver adjustment while a vernier or fine control on liquid level is operated by a panel-front knob.

Standard models operate from 115-v 60 cps supply while special units are available for 230-v or 25 cps operation. The snap-action relay included in the unit is rated for 10-amp at 115 and 230 v. An indicator light in the panel front indicates operation of the relay—burning at full brilliance when the relay is open, at half brilliance when the relay is closed. Thermo Instruments Co.

17—STEAM BOILER

Internally-fired marine type, for burning either oil or gas

The Model LO Supermarine burns gas and No. 3 oil or lighter. It has 7 sq ft of water backed heating surface for each boiler horsepower developed which, according to manufacturer, assures the boiler a long life of peak efficiency with either fuel. The shell is internally fired



two-pass marine type with a large diameter combustion tube and a battery of return tubes correctly located with respect to the firing tube, it is pointed out, and there is ample steam space with a safe depth of water.

The combustion system is simple. The fan supplies all combustion air, and spark ignition is automatic with either fuel; there is no pilot. Electronic safety controls are provided to shut off the burner in the event of flame or electric failure. Company says that changeover from one fuel to the other is easily and quickly accomplished and suggests this boiler for use where use of both fuels is contemplated — also for hospitals and other plants where emergency standby equipment is required. Sellers Engineering Co.

18—SWEEPING COMPOUND

Finely ground cellulose fiber material of high absorbency

A new floor cleaning compound, Cottontex is claimed to absorb more than eight times its own weight, making it well suited for absorbing oil, greases, battery acids, gasoline and liquids. It can be used for cleaning hands as well as floors.

Company says Cottontex absorbs immediately and, when swept up, leaves the floor clean and dry — doesn't combine with oil or grease to form a compound which has to be scraped up. And since it is soft and non-corrosive, it will not harm wood, concrete, terrazo or painted floors. Manufacturer of Cottontex says it is economical to buy and use, offers a free sample to power engineers who want to see how this sweeping compound works. Cottontex Mfg. Co.

Want more details on these new products? Just circle the item numbers on post cards on pages 37 and 115

19—FLOW LIMITER VALVES

Are adaptable as excess flow, automatic drain or dump valves

A precise new valve designed to flow in one direction up to a pre-determined rate but shut off quickly and tightly to prevent higher flows, while allowing unrestricted flow in the opposite direction is announced. Offered as an excess flow or flow limiter valve and serving equally well as an automatic drain or dump valve, it is expected to meet a need in many fields. The valve can be pre-set to close off when any given flow rate is reached.

The sensitive response and reliability of the valve is attributed to the use of company's "Circle Seal" principle together with a spring actuated poppet design to insure accurate control of flow. These valves are made with male tube or pipe connections on the discharge side in the restricted flow direction, and with either male or female connections on the inlet side. James-Pond-Clark.

20—MECHANICAL METER

For flow and level applications, offers reduced maintenance

The improved Magna-Clutch uses a magnetic coupling to connect the float in the manometer with the external metering parts; it has the manometer completely sealed. The meter is announced as particularly desirable for use on toxic, corrosive or inflammable fluids because no leakage is possible.

Manufacturer attributes the low maintenance requirement to the fact that the pressure bearing is eliminated. Also, the manometer can be inspected and cleaned and the calibration checked without disconnecting the pressure piping. Accuracy is obtained through the use of a large float, long float travel and magnetic linkage, company explains, and is maintained even at high static pressures with no hysteresis.

Flexibility of differential range is provided by seven interchangeable range tubes (20 to 750 in.). The Magna-Clutch is produced in recording, integrating, pneumatic transmitting and controlling styles for static pressures to 2500 psi. Penn Industrial Instrument Corp.

21—SCRUBBER SYSTEM

Multiple action, to remove large volumes of dust from stack gas

The Type V Liquid Precipitator Multiple-Action Scrubber combines six principles of dust precipitation and is suggested controlling dust from rotary dryers, cyclines, kilns, mixers and stacks of asphalt and chemical plants. Less water is required than for many scrubbers, it is explained, the average draft loss being about 2 in. of water column. The scrubber is offered in capacities from 1500 to 48,000 cfm.

In operation, dust removed from the air is reduced to a watery sludge which can be discharged into a tank or pond for removal of solids. A recirculation system can be used where water supply is a problem.

First of the several operating principles involved — centrifugal separation of larger dust particles and precooling of gases — begins where the dust enters. Here multiple scrubber throats provide directional and velocity control of the gases. At the same time, the velocity is accelerated so the entrained solids impact on impinger plates. A water jet also impinges on these plates, wetting them and breaking up the water into droplets for scrubbing of the solids from the gas stream.

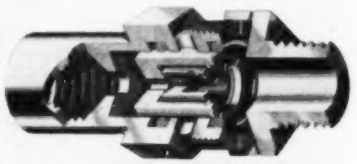
The third operating principle involves expansion of gases in the lower expansion chamber to discharge the bulk of the solids in a slurry at the lower drainage outlet. Then inertial separation occurs through reversal of gas flow upward through the center stack, removing part of the wetted solids in the process. From this stack the gases enter another expansion chamber to reduce velocities once more. Again the gases pass through multiple scrubbing stages for removal of smaller particles.

Final cleansing of the stack gases is by precipitator elements. In this phase Compound M Concentrate is applied for final removal of low micron particle sizes and entrained mist. From here the cleaned gases are discharged. Johnson-March Corp.

22—QUICK-RELEASE VALVE

For air pressures from 0 to 250 psi on pneumatic clutches to 1500 hp

A quick-release valve designed not to chatter is announced. According to manufacturer, the valve's features include light weight and compactness which permit its use on rotating elements without disturbing dynamic balance; a built-in orifice to prevent acci-



dental removal of orifice from the line and eliminate possibility of pressure equalization responsible for chatter; double-piston design for smooth, quick-releasing action. Deublin Co.

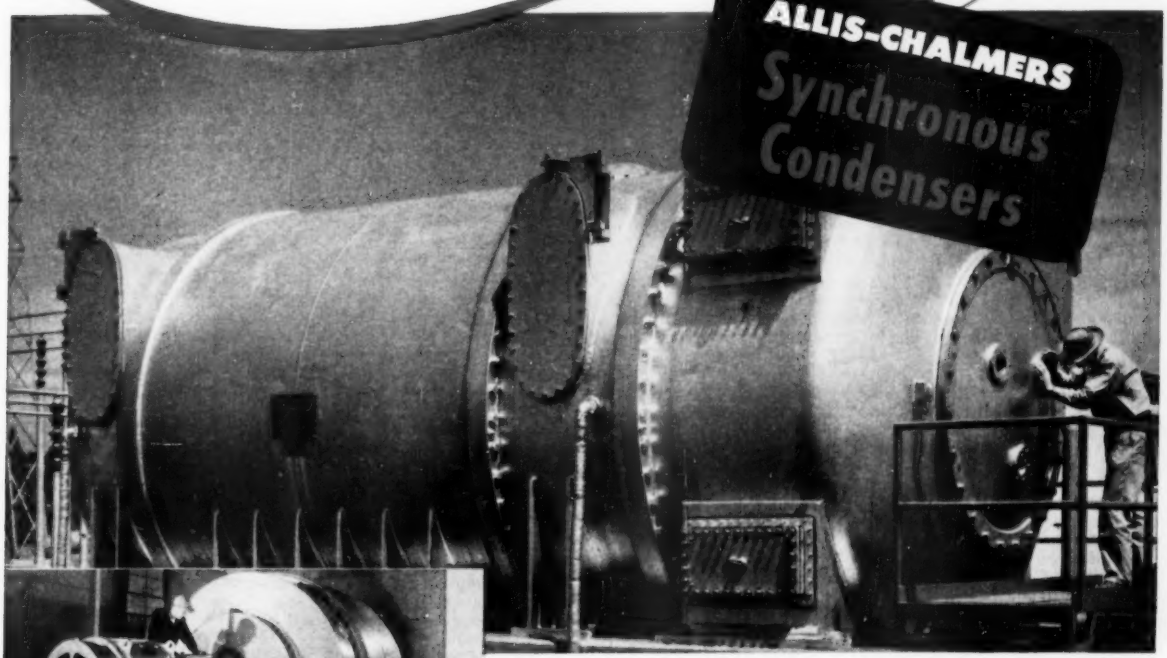
23—FAULT ANALYZER

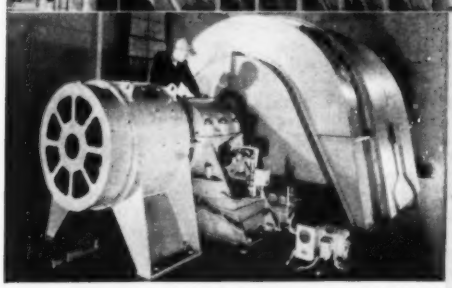
Is designed for faster and safer location of line faults

Operating from any powerhouse, transformer bank or substation, the Model 124 pinpoints shorts, grounds or open circuits at ranges from ½ to 200 miles, manufacturer announces. The instrument is direct reading and described as lightweight and simple to operate, and as weatherproof and unaffected by climatic conditions. It can be attached to any line, using regular carrier coupling capacitors. Tests can be made phase to phase or phase to ground.

The Model 124 operates on radar techniques, sending a high amplitude pulse down the line under test. A complete picture of the line is presented on a built-in radar-type "A" scope. Calibrated linear sweep ranges of 5, 25, 50 and 100 miles are provided. The instrument is operated from a 105/125 v a-c supply and includes viewing hood and power cord. Sierra Electronic Corp.

Better than Rebuilding Transmission Lines





Pacific Coast system uses 50,000-kva hydrogen-cooled condenser (top view), and 20,000-kva air-cooled unit (bottom view).

Besides minimizing losses, hydrogen cooling results in a design suited to outdoor operation. Air-cooled units can also be built for outdoor use, and for industrial power-factor-correction applications.

Regulex amplifier control, which acts as both regulator and pilot exciter, is available for all synchronous condenser ratings.

Regulex is an Allis-Chalmers trademark.

FOR WIDESPREAD power systems, synchronous condensers can frequently be used in place of added or larger transmission lines. This is possible because, by supplying reactive kva, they assure efficient use of power lines.

But condensers can do more than just cut conductor requirements. They also provide voltage regulation on a wholesale scale, and furnish rotating inertia for improved system stability.

Custom-engineered to fill system requirements and to fit installation conditions, Allis-Chalmers synchronous condensers can help you hold down transmission costs. For more information on units for utility or industrial applications, call in your A-C representative, or write for Bulletin 05B7285. Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3960

ALLIS-CHALMERS

For more data circle 526 on Post Card

POWER PLANT *Construction News*

Milpitas, Calif. — Ford Motor Co., Dearborn, Mich., plans power house at proposed new assembling plant at Milpitas (Santa Clara County), where tract of 160 acres of land has been acquired, fronting on Capitol Ave. It will comprise several large one-story buildings for main production, with smaller auxiliary structures. Entire project will represent an investment of about $35,000,000. Proposed to begin work soon.

Morro Bay, Calif. — Pacific Gas & Electric Co., 245 Market St., San Francisco, Calif., has authorized plans for new steam-electric generating plant at Morro Bay (San Luis Obispo County), where large tract of waterfront property has been acquired. New plant will be designed for an ultimate capacity of 300,000-kw., divided into several turbine-generator units, with high-pressure boilers and auxiliary equipment. Entire project will represent a reported investment of about $44,000,000, including power switching stations, transmission lines and other operating facilities. Work on initial unit will begin soon.

Oakdale, Calif. — Oakdale Irrigation District and South San Joaquin Irrigation District, 322 East D St., Oakdale, have plans maturing for joint construction of new hydro-electric generating stations at four points on Stanislaus River, Tuolumne and Calaveras Counties, known as Donnells Dam, Beardsley Dam, Tulloch Dam and Goodwin Dam, respectively, with installation of hydraulic-turbines, electric generators and other equipment, to develop large gross output. Work will include dam construction, penstocks, reservoirs and other appurtenances. Entire project will represent a reported investment of $50,000,000. Proposed to begin work in near future. International Engineering Co., Inc., 74 New Montgomery St., San Francisco, Calif., is consulting engineer.

Santa Cruz, Calif. — William Wrigley, Jr., Co., 410 N. Michigan Ave., Chicago, Ill., plans boiler house at new branch chewing gum manufacturing plant at Santa Cruz, where tract of about 5 acres of land was secured a number of months ago. It will comprise a number of buildings, with equipment and facilities for large production and is reported to cost about $3,000,000. Proposed to begin superstructure in June and to have plant ready for service in 1954.

Pahokee, Fla. — American Food Products Corp., 533 Greenwich St., New York, N. Y., malted and powdered milk, is reported planning boiler house at proposed new milk processing and production plant at Pahokee (Palm Beach County), where large tract of land has been selected. Cost estimated approximately $1,500,000, including equipment.

Atlanta, Ga. — Eastman Kodak Co., Kodak Park, Rochester, N. Y., plans boiler house at new branch plant in industrial district on Peachtree Blvd., Atlanta. It will comprise a main one-story building, about 110,000 sq. ft. floor space. Cost reported close to $3,000,000, with machinery. Work is scheduled to begin soon.

New Orleans, La. — New Orleans Public Service, Inc., 317 Barrone St., will expend approximately $17,000,000 in 1953 and $12,000,000 in 1954 for expansion and improvements in plants and system, including increased generating capacity, transmission and distributing lines, power substations and other operating facilities.

Bell, Mich. — Kelley Island Lime & Transport Co., Leader Bldg., Cleveland, Ohio, plans power house at new limestone plant at Bell, near Alpena (Presque County), to be operated by company for a group of five steel concerns. It will comprise a number of buildings for various production service and will have a rated capacity of about 8,000,000 tons per annum. Cost reported approximately $12,000,000. Work is scheduled to begin at early date, with completion in spring of 1954.

Detroit, Mich. — Detroit Edison Co., 2000 Second Ave., has arranged an expansion and improvement program in 1953 to cost about $84,700,000, with work to include additional generating capacity, power substations, transmission lines and other operating facilities. Different features of project will proceed at once.

Jackson, Mich. — Consumers Power Co., Jackson, plans expenditure of close to $1,400,000 for expansion and improvements in plants and system in Central Division, Greenville, Mich., including generating facilities, power substations, transmission lines, etc.

Kalamazoo, Mich. — Hytron Radio & Electronics Co., Salem, Mass., plans power house at proposed new plant for manufacture of television picture tubes at Kalamazoo, where site has been selected. It will comprise a main one-story building, aggregating about 235,000 sq. ft. floor space, and is reported to cost close to $3,500,000. Proposed to begin work soon, with plant to be ready for service in fall of 1954. Company is a subsidiary of Columbia Broadcasting System, New York, N. Y.

Jackson, Miss. — Mississippi Power & Light Co., Lampton Bldg., has arranged for sale of new bond issue to total about $12,000,000. Proceeds to be used for expansion and improvements in plants and system, including additional generating facilities, power substations, transmission lines and auxiliary operating structures.

Springfield, Mo. — Kraft Foods Co., 500 N. Peshtigo Ct., Chicago, Ill., cheese and other dairy products, plans power house at new plant near city limits of Springfield, where tract of over 30 acres of land has been purchased. Factory will be equipped for processing and manufacture of cheese and allied products. Cost reported over $1,750,000. Company is a unit of National Dairy Products Corp., 260 Madison Ave., New York, N. Y.

Five Falls, N. Y. — Niagara-Mohawk Power Corp., Electric Bldg., Buffalo, N. Y., will proceed at once with work on new hydroelectric generating station, at place known as Five Falls, on Raquette River. This will be the second of five such generating plants to be built by company in that area, and will be equipped for initial rating of 20,250-kw. In near future work will proceed on other units of project.

Ithaca, N. Y. — New York State Gas & Electric Co., Binghamton, N. Y., plans expenditure of about $25,200,000 for expansion and improvements in power plants and system. It is understood that portion of fund will be used in connection with new generating station at Heddens, near Ithaca, where company has site of about 100 acres of land, fronting on Cayuga Lake, to be equipped for an initial rating of about 135,000-kw.

Albuquerque, N. M. — Public Service Co. of New Mexico plans expenditure of about $12,000,000 for expansion and improvements in power plants and system during next 24 mos., including increased generating facilities, power substations, transmission lines and other operating facilities.

Cambridge, Ohio — Champion Spark Plug Co., Ceramic Division, 8525 Butler Ave., Hamtramck, Detroit, Mich., spark plug insulators, plans boiler house at proposed new branch plant at Cambridge, where tract of 20 acres of land has been secured. It is understood that initial output will be for Government service. Entire development reported to cost close to $2,000,000, with equipment.

Cincinnati, Ohio — Ideal Packing Co., 2141 Paymiller St., meat-packer, plans boiler house at new processing and production plant on local site on Grand Ave., near Northfield Ave. It will comprise several buildings and is reported to cost approximately $500,000. Grunkemeyer & Sullivan & Associates, 3717 Eastern St., Cincinnati, are architects and engineers.

Bryan, Tex. — Municipal Light & Power Department plans expansion in municipal utilities, including new generating plant to supplement present Diesel-electric station, with installation of turbine-generator and accessories, to cost in excess of $1,000,000. Municipality has authorized a bond issue of $3,000,000 for entire program.

Corpus Christi, Tex. — Central Power & Light Co., Corpus Christi, plans expansion and improvements in power plant and system, to cost close to $3,000,000, including increased generating facilities, transmission lines, power substations and other operating facilities. Program has been approved by Defense Production Administration, Washington, D. C.

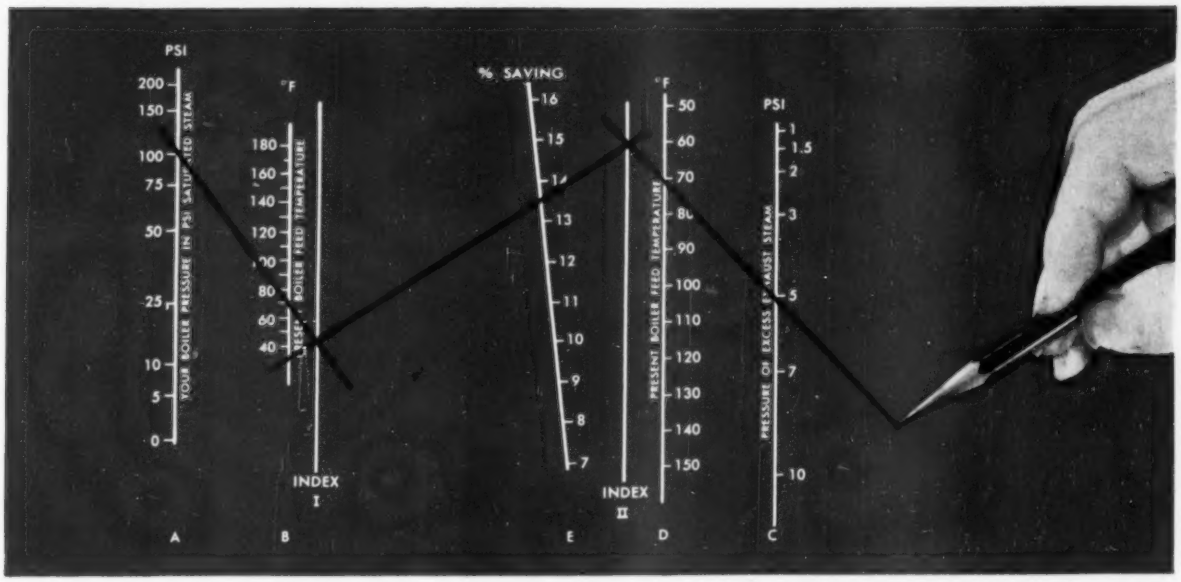
Fort Worth, Tex. — Texas Electric Service Co., Fort Worth, is considering expansion in local steam-electric generating station, with installation of new turbine-generator unit, 115,000-kw. rating, high-pressure boiler and auxiliary equipment. Entire project is reported to cost about $16,500,000. It is understood that work is scheduled to begin before close of year.

Orange, Tex. — Spencer Co., Dwight Bldg., Kansas City, Mo., is reported planning boiler plant at proposed new factory at Orange for manufacture of industrial and agricultural chemicals. It will comprise several buildings and is reported to cost close to $1,000,000.

Portsmouth, Va. — Virginia Electric Power Co., 7th and Franklin Sts., Richmond, Va., will proceed with work on second unit of new steam-electric generating plant at Portsmouth, previously referred to in these columns. Initial unit of 110,000-kw. rating recently was placed in service. New generator and auxiliaries will have a similar rating, and is estimated to cost close to $15,000,000, developing a total cost of approximately $33,000,000 for new plant. Stone & Webster Engineering Corp., 49 Federal St., Boston, Mass., is consulting engineer.

Morgantown, W. Va. — Mathieson Chemical Corp., Mathieson Bldg., Baltimore, Md., and American Enka Corp., Enka, N. C., plan power house at proposed new plant at Morgantown, to be constructed jointly for manufacture of chemical products used as raw material in connection with production of nylon fibre. Cost reported over $1,500,000. Engineering department of first noted company in charge. Proposed to begin construction work on this development at early date.

Use exhaust steam and cut fuel costs with a Swartwout Feed Water Heater

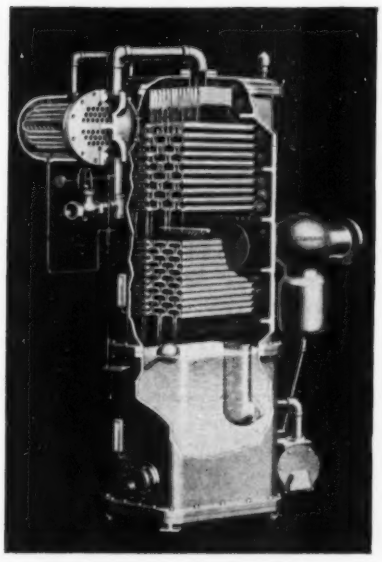


1 UTILIZING RESIDUAL HEAT in exhaust steam, you effect a direct saving in fuel costs of approximately 1% for each 11°F increase in boiler feed water temperature. Furthermore, you improve boiler operation in other important, cost-cutting ways. Faster steaming rate . . . removal of the soluble gases that cause costly corrosion in boiler and economizer . . . reduction of temperature strains.

Here's how to figure your fuel savings. Connect point on A to point on B; project line to intersect Index I. Connect points on C and D; project line to intersect Index II. Connect points on I and II and read your fuel savings on Scale E. The example given (100 psi saturated steam boiler using 70°F feed water and 5 psi exhaust steam) shows a *saving of approximately 13.6% of your present fuel cost.* A-5063

Swartwout

POWER PLANT EQUIPMENT
PROCESS INDUSTRY CONTROLS
INDUSTRIAL VENTILATION

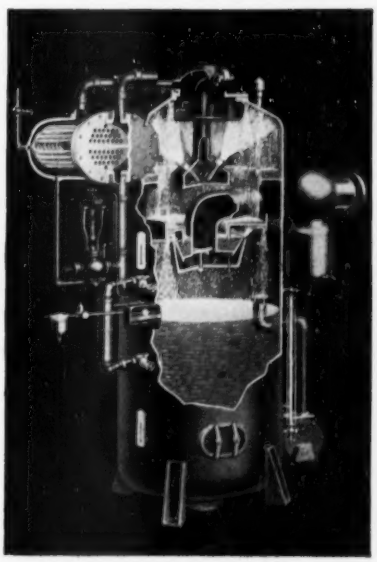


2

SWARTWOUT TRAY TYPE HEATERS, by using counterflow principle, give greatest degree of deaeration because water is in contact with clean steam just before dropping into storage section. Swartwout cast iron or steel deaerating heaters (.03 oxygen guarantee) and deaerators (.005 oxygen guarantee) can be supplied with cast iron or stainless steel trays.

3

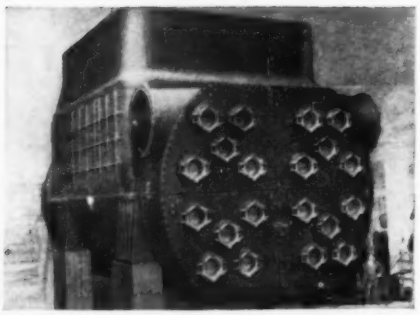
SWARTWOUT SPRAY TYPE (atomizing) deaerators are of all-steel construction, give feed water with oxygen content guaranteed not to exceed .005 cc per liter of water. All surfaces which are subjected to impingement of water are made of corrosion-resistant stainless steel. Swartwout feed water heaters are specially designed to meet your individual requirements and range from 5000 to 300,000 lb. capacities.



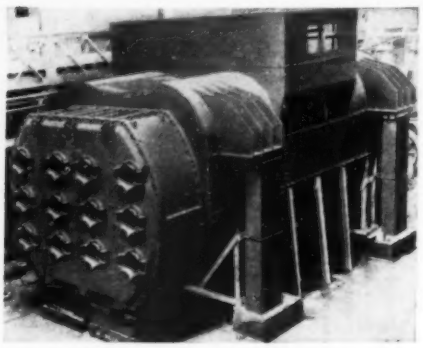
SEND FOR BULLETINS S-18-E, S-210 • THE SWARTWOUT COMPANY, 18511 EUCLID AVENUE, CLEVELAND 12, OHIO

For more data circle 527 on Post Card

CON EDISON'S EAST RIVER ELECTRIC GENERATING STATION at 14th Street, New York City, will contain the new Worthington 125,000 sq-ft condenser. The shell, which is to be installed under 160,000-kw Unit No. 7, will contain nearly 105 miles of ⅝" O.D. aluminum brass tubes and will require 138,000 gpm of East River water supplied by two 54 in. Worthington "Mixflo" vertical single suction volute circulating pumps.



WORTHINGTON CONDENSER installed in 1931 to serve 160,000-kw Unit No. 7, Hudson Avenue Station. Tube sheets were drilled for 110,000 sq ft with 101,000 sq ft installed.



ONE OF TWO 74,500 SQ-FT 2-PASS WORTHINGTON CONDENSERS serving 60,000-kw Units 14 and 15 at Waterside Station No. 1.

Con Edison once again installs "largest" condenser

On several occasions over the past fifty years, Worthington has been selected to build the "world's largest" surface condensers in single shell design.

In 1919, a 70,000 sq-ft condenser was installed under a 35,000-kw turbine-generator for a prominent utility company. This was the largest single shell surface condenser of its day.

In 1931, Brooklyn Edison Company (now Consolidated Edison Company of New York, Inc.) installed, under 160,000-kw Unit No. 7 at the Hudson Avenue Station, the "world's largest" at that time, a 101,000 sq-ft single-pass Worthington condenser. This was followed, in 1949, by two 74,500 sq-ft condensers for Waterside Station No. 1.

Now, Worthington is again building for Con Edison the "world's largest" single-shell condenser ever ordered, 125,000 sq-ft, single-pass, for the 160,000-kw Unit No. 7 addition to East River Station.

Worthington, with over a century of experience in the manufacture of steam power equipment, is prepared to build efficient condensers in all sizes. Let us advise you, without obligation, on your new installation.

Write, stating requirements, to *Worthington Corporation, Steam Power Division, Harrison, New Jersey.*

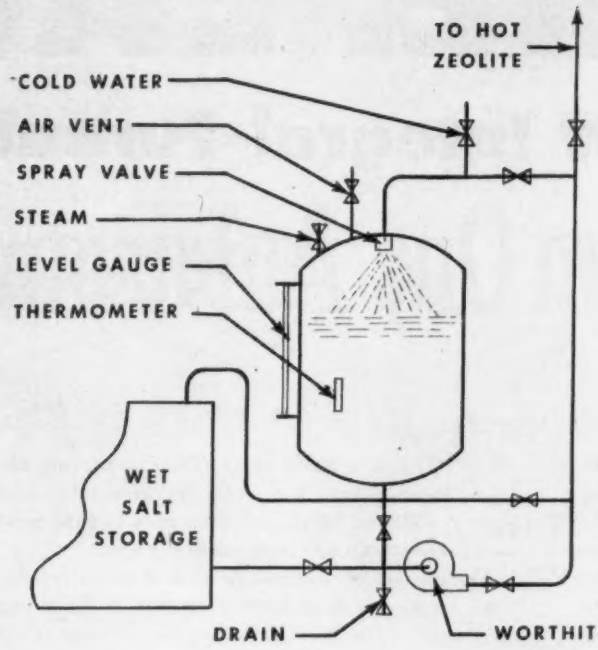
Z.2.2

World's Broadest Line of Steam Power Plant Auxiliaries

WORTHINGTON

Condensers

For more data circle 528 on Post Card



SEQUENCE OF OPERATION OF WORTHINGTON'S HOT-Z REGENERATING SYSTEM*

1. To initiate service, gradually raise zeolite to operating temperature by regulating steam supply to injection water.
2. Return excess water to wet salt storage or discharge through drain.
3. Fill heater storage with saturated brine to desired level.
4. Recirculate until operating temperature is reached.
5. Deliver measured, heated and deaerated brine to zeolite.
6. Return excess brine to wet storage for resaturation.
7. To cut zeolite out of service, inject fully heated water and gradually reduce temperature by regulating steam supply.

*patent applied for.

MAXIMUM LIFE FROM ZEOLITE

How Worthington's Hot-Z Plant protects Zeolite by maintaining uniform temperature during regeneration

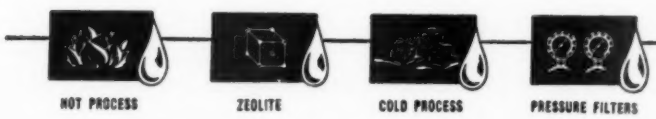
Another feature to check into when you're choosing Hot-Z treating equipment: *the regenerating system.*

For maximum life of the zeolite, two requirements should be met. 1. *A uniform temperature* should be maintained while regenerating the zeolite: that is, the regenerant solution should be held at essentially the same temperature as the water under treatment. 2. When putting a softener into or out of service, the temperature of the zeolite should be raised or lowered *gradually.*

Worthington has accomplished this dual objective with a brine deaerating heater for regenerating the hot zeolite. Its operation is explained in the diagram and accompanying caption. Deaeration is desirable to retard corrosion which might be caused by oxygen in the brine.

This heating system is just one of several exclusive features you'll find in every Worthington Hot-Z system. Remember, too, that Worthington makes all of the major types of water conditioning systems. Let us study your problem and recommend the most suitable solution. Write, stating service conditions in detail, to Worthington Corporation, Water Treating Division, Harrison, N. J.

J.2.3



Worthington Makes More of the Equipment for ALL Types of Water Conditioning Systems

WORTHINGTON

Water Conditioning

For more data circle 529 on Post Card

52 REPEAT

for B&W Integral-Furnace

from One Automotive

Seventeen years ago, in 1936, a large automobile manufacturing concern ordered its first B&W Integral-Furnace Boiler. Since then, 52 times—under 52 different sets of circumstances—the customer has come back for more units of this type. Total steam capacity installed and on order now amounts to over 5,750,000 lb/hr, with unit capacities ranging from 20,000 lb/hr to 190,000 lb/hr.

Like this user's own splendid reputation for customer loyalty, repeat orders represent a high percentage of total B&W Integral-Furnace Boiler sales . . . testifying to the high availability, over-all economy, and operating efficiency of these B&W units. Their cost-saving advantages, listed below, have won industry-wide endorsement as reflected in sales of these units to date, totaling well over 191,000,000 lb of steam per hour.

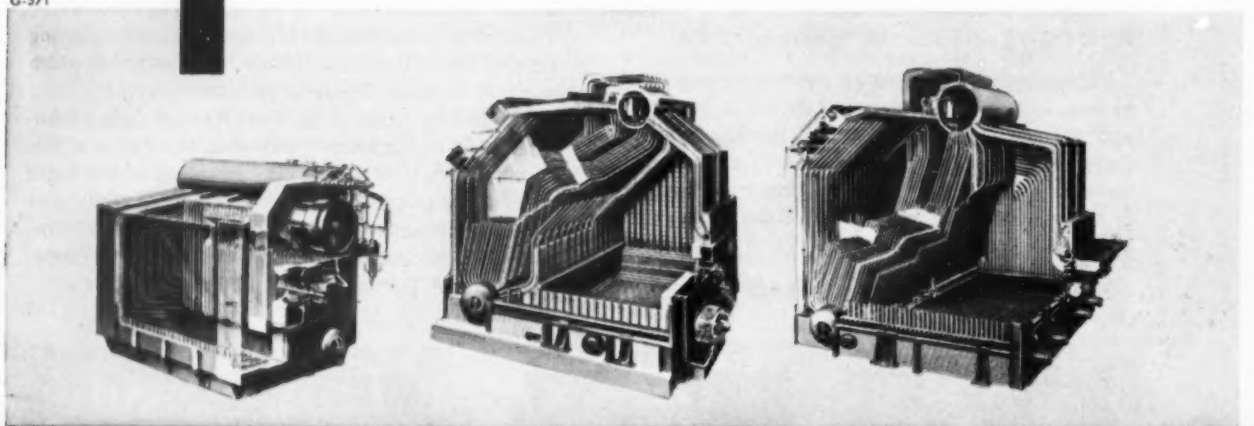
Modern B&W Integral-Furnace Boilers include designs ranging from as little as 2800 lb of steam per hr, to 350,000 lb/hr, for unusually wide coverage of industrial, commercial and institutional steam requirements.

Write today for descriptive literature covering any or all of the boilers in the B&W Integral-Furnace family, to help you in planning *your* company's next expansion or modernization program.

COST SAVING FEATURES

Minimum floor space and headroom requirements
High fuel economy
Smokeless combustion
Adaptable to all fuels and firing methods
Economical fast steaming
Water-cooled furnace
Clean, dry steam at all ratings even with high boiler water concentrations
Quick response to wide and heavy load swing demands
Easy to inspect and clean
High availability with least attention

G-571



TYPE FM
2,800—28,000 lb/hr
up to 250 psi
Oil and Gas Firing

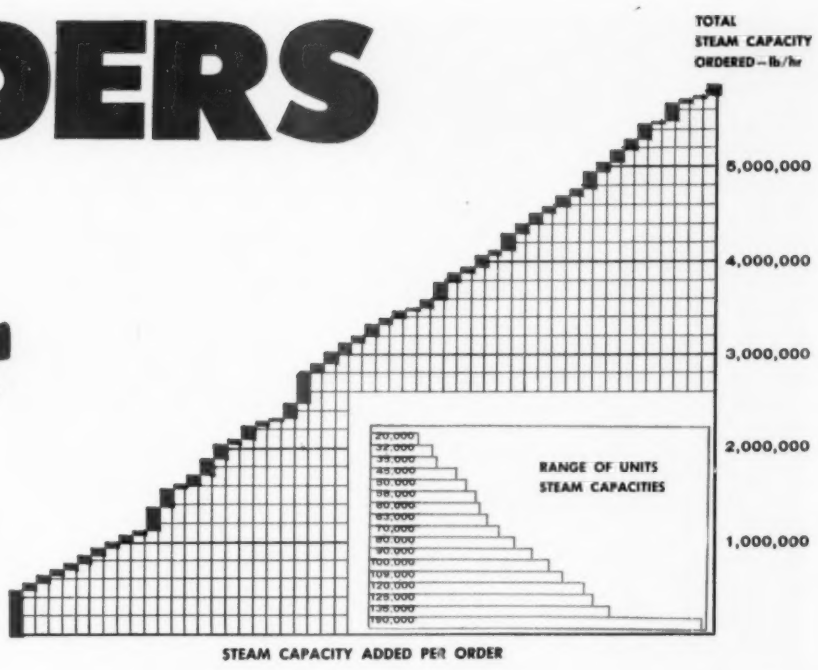
TYPE FF
8,000—50,000 lb/hr
up to 600 psi
Stoker, Oil, and Gas Firing

TYPE FJ
30,000—70,000 lb/hr
up to 800 psi
Stoker, Oil, and Gas Firing

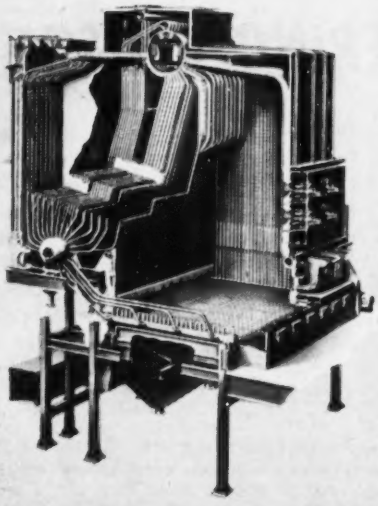
ORDERS

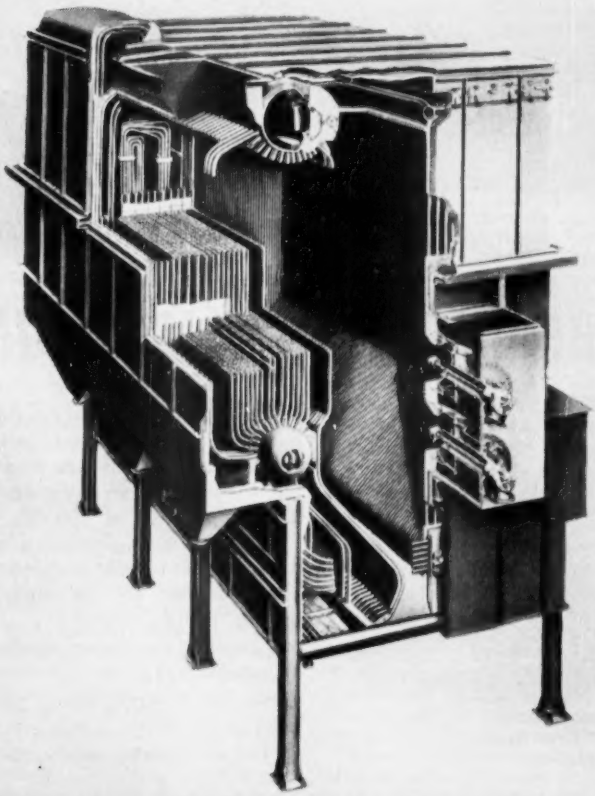
Boilers

Customer



BABCOCK & WILCOX



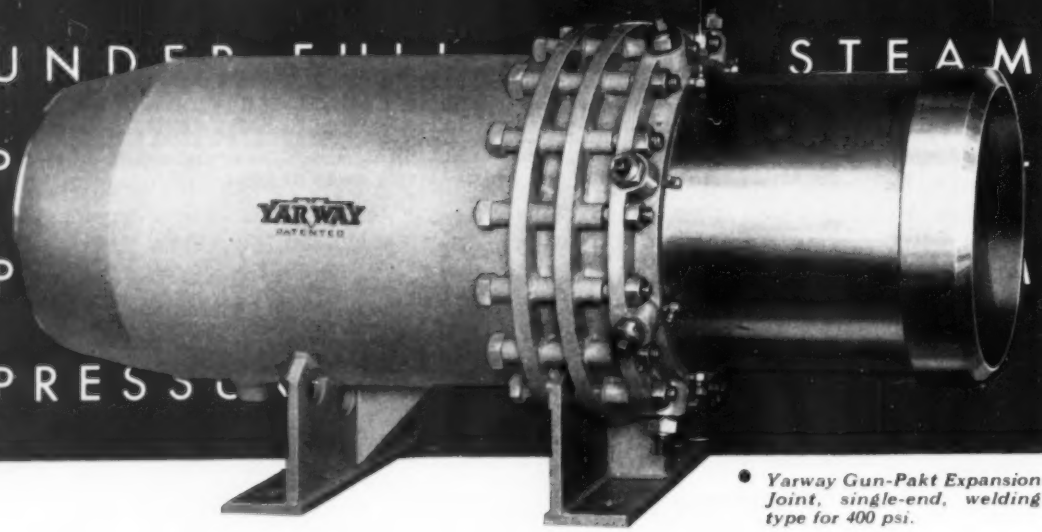


TYPE FL
60,000—150,000 lb/hr
up to 1050 psi
Stoker, Oil, and Gas Firing

TYPE FH
50,000—350,000 lb/hr
up to 1050 psi
Pulverized Coal, Oil, and Gas Firing

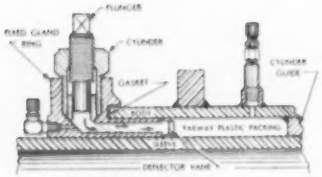
For more data circle 530 on Post Card

GUN-PACKED UNDER FULL STEAM PRESSURE • GUN-PACKED UNDER FULL STEAM PRESSURE • GUN-PACKED UNDER FULL STEAM PRESSURE



• *Yarway Gun-Pakt Expansion Joint, single-end, welding type for 400 psi.*

BEHIND IT...AN ENGINEERING REASON



Cross-section of Gun-Pakt feature.

More large central station heating plants are using Yarway Gun-Pakt Expansion Joints in their steam distribution lines than any other type. This popularity of Yarway Gun-Pakt Expansion Joints in public utilities, institutions and industrial plants is due to the engineering reason behind them . . . *they are packed by a gun under full steam pressure.*

No shutdowns of steam lines, no production delays . . . you just insert a plug of Yarway plastic packing, twist a wrench, and the joint is tight, the job is done.

Such labor saving features, combined with impressive records of low maintenance requirements, make Yarway Gun-Pakt Joints a natural selection for your steam lines. Certainly you'll find them worth investigating.

Write for Yarway Expansion Joint Bulletin EJ-1912.

YARNALL-WARING COMPANY
114 Mermaid Avenue • Philadelphia 18, Pa.

YARWAY | gun-pakt expansion joints

For more data circle 531 on Post Card

LETTERS TO THE EDITORS

Here and There

IT IS WITH interest I read of your visit to the J. I. Case plant in Racine, Wis. (February issue, page 55). Many of us have heard of Cole Morrow and of his accomplishments in the power plant field. I believe an article or series of articles on his work would be in order. He seems to be the type of engineer who gets things done — and by his own ingenuity. Many of his innovations are unique, to say the least, and his experiences would make interesting reading.

Milwaukee, Wis. HAROLD E. WEISS

Can We Save the Old Engines?

ABOUT TWO YEARS ago, I wrote to a number of museums in the United States in regard to the preservation of at least some of the parts of the 10,000-hp reciprocating steam engines at the 74th Street Power Plant of the New York City Transit System, which were about to be removed. For various reasons, none of the museums was able to take any action in the matter.

Those engines have since been scrapped. However, a number of similar engines are still in existence in the 59th Street Power Plant of the New York City Transit System and will probably be there for a few years.

These engines were the last and largest ever built for power plant use and so they have considerable historic interest. The preservation of a complete engine would be a gigantic undertaking. However, it is hoped that some museum will be able to preserve at least some of the parts, such as a low-pressure piston, piston rod, connecting rod and crosshead.

Another possibility would be for some museum to have a model made of these engines similar to the models of marine steam engines that are in some of the nautical museums.

In addition to my interest in these engines as a power engineer, I also have a personal interest in them, for I was associated with these units for 35 years, being Superintendent of Motive Power for the Interborough before its consolidation into the New York City Transit System and at the time of my retirement in 1949, Superintendent of Power Generation for the System.

New York, N. Y. H. B. REYNOLDS

Boom Intake

THE FEBRUARY issue of POWER ENGINEERING contains the article on the new boom intake proposed as a more satisfactory and more economical installation for screening condenser cooling water. I was quite interested in this article and noted that, according to the note on page 62, up to the present time a screen like this has not been manufactured or placed in service.

The design has some unique features and I will be glad to see someone else try it out, but from my experience it appears that there might be quite a number of things that would detract from its practical value.

Personally, I would never feel safe in eliminating trash racks ahead of the screen. I have seen cases where ice or drift wood have damaged steel racks made up of 5/16 in. by 3 in. wide steel bars due to the material floating against the racks when driven by a wind. When I think what the effect would be on the screen baskets under these conditions I am fearful that the effectiveness of the screen would be destroyed. To use a structure that would place racks in front of the boom type screen would mean a much larger concrete structure than with a standard screen and would, I believe, unquestionably result in a greater cost than the conventional design.

Mr. Rodemeyer proposes a screen driving system that would be submersible. This, in itself, would increase the cost materially, and from our experience it is not uncommon, even under favorable conditions, for something to jam a screen, or the natural wear of the chain and sprockets to cause a unit to hang up. To protect against serious damage at such times all screen mechanisms are provided with a shear pin in connection with the sprocket drive. It occurs to me that should a shear pin fail at time of high water when total drive equipment is submerged it would, to say the least, produce a very awkward situation for replacement of shear pin and to back up screen and clear the trouble.

The author suggests that when the water is not at maximum high water, but above the normal trash trough, the debris can be washed off by sprays and carried away by the current. The mere fact that water is being drawn in through the screen, however, would mean generally that a greater portion of the debris would simply go back onto the screen and not be carried downstream.

The above are a few conditions which appear to me to be rather serious objections to this type of design, and before adopting such a plan I would definitely want to see an installation which had been operating satisfactorily for a few years.

Michigan POWER ENGINEER A

REGARDING the boom intake screen (February issue) our casual comment points out that the inclined screen has no support from the rear as is necessary to cope with large pressure drops across it when partly clogged.

Our interest in screens of this nature is essentially zero because our water levels do not vary appreciably.

Wisconsin POWER ENGINEER B

I READ the article on the boom intake screen with interest although it is not conveniently applicable to our type of installation. All of our plants are located on tidewater where the normal variation of tide level is about 7 or 8 ft, with a complete tidal cycle each 12 hours.

We receive fuel by large colliers or barges, so must maintain a flush dock front for unloading. This condition would necessitate recessing of the screen, with obvious disadvantages. With our small tidal variations the conventional screen is not subject to the conditions prevailing on river installations with high flood level.

a) I believe the initial installation cost would be less than that of the conventional screen for river plants having high flood level. Installation and removal might be accomplished by the use of a tractor crane when conditions necessitated major maintenance;

b) Screening effectiveness should be good, under average water conditions, especially with low water. However, with some water conditions, which we experience, it is necessary to aid the jet cleaning with hand brushing to avoid loss of capacity. The design illustrated does not indicate accessibility for such cleaning;

c) Ease of operation should compare favorably with conventional screens, except where supplemental cleaning is necessary;

d) In plants where there is little or no current flow to dispose of the refuse, flushed from the screen, other means of disposal would be required. Maintenance should be somewhat lower than the normal screens of greater length due to the reduction in the number of pins and links. Some full-scale experience would be required to determine the life and effectiveness of the bottom sealing arrangement, as many of our problems with screens occur at this point.

The sea water we use is contaminated by various wastes, which introduces a serious corrosion problem and necessitates premium alloys for construction. This might add unduly to the cost of a submersible arrangement.

New York POWER ENGINEER C

(Continued on page 96)

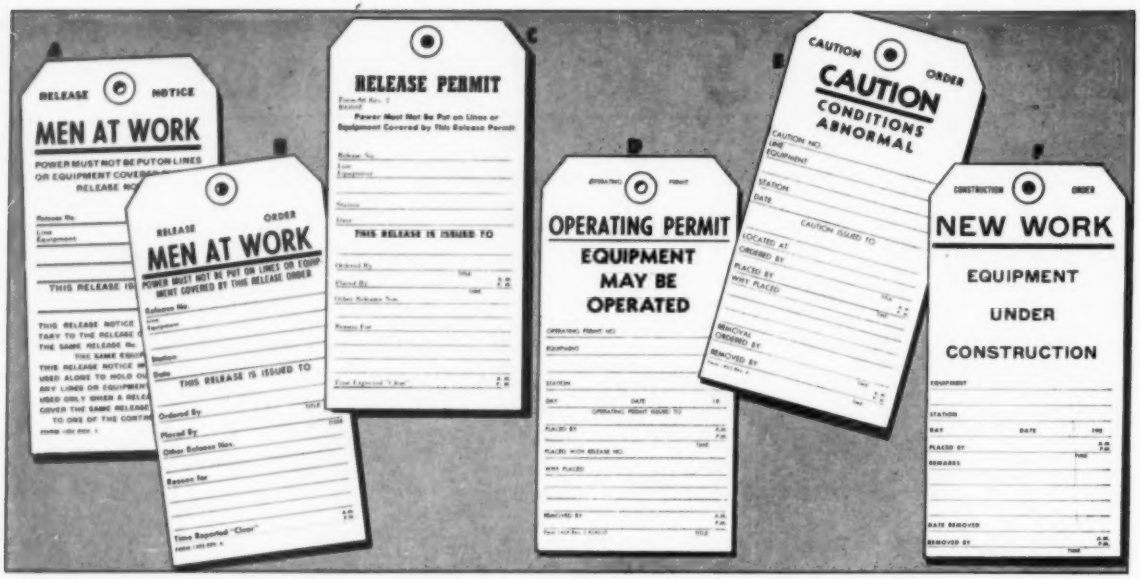


Fig. 1. Safety tags used by West Penn Power Company. They are, from left to right, Release Notice (Red), Release Order (Pink), Release Permit (Yellow), Operating Permit (Green), Caution Order (White) and Construction Order (Blue). Instruction printed on the back of each tag explains how it should be used

Safety Tagging Works

When taking part of a power system out of service, accidents may happen through misunderstandings or errors of judgment. West Penn Power Company's procedure makes this, and other operations, nearly independent of human failings. It applies equally well to utility systems and industrial power systems

THE SAFETY TAGGING SYSTEMS of all our companies, although they vary in details and application, are intended to meet three principal requirements: first, and most important, the protection of men at work under all conditions; second, the protection of equipment from damage; third, the designation of abnormal conditions.

The tagging system of the West Penn Power Company has, since its development over 25 years ago, attempted to meet these requirements by applying the following fundamental rules:

1. System should be applicable throughout entire organization. It should apply with equal force to both electrical and mechanical equipment and be broad enough to cover every condition that arises.

2. The system should be easily understood and reasonably simple in application. A system that is too elaborate becomes burdensome and encourages unsafe short cuts. Simplicity, however, should not be obtained at the expense of safety.

3. Maximum protection will be obtained by the use of more than one type of tag, each of which has a single purpose. The name of each tag should indicate its general use. Each tag should be a different color.

4. Maximum safety can be obtained only when the system is rigidly supervised by an authority which is responsible for assigning the tags and issuing the rules for their use.

5. There must be a fundamental and strictly enforced rule that all lines and equipment must be considered energized unless tags are placed to designate other conditions.

6. A set of written instructions should be issued to cover use of the tags. Such rules should be enforceable under all conditions, and if found that any rule cannot be applied to a certain practice, either the rule or the practice should be changed.

7. The system should be workable by two groups: first, the load dispatchers, who study its application to the general layout of lines and equipment; second, the workmen, who are primarily interested in effect of system on working conditions.

8. System should include written records of switching and tagging operations, by both load dispatchers and operators. Such records provide a check on correct application of system and on any weakness that develops.

In the tagging system used by the West Penn Power Company, the rules given above are made effective by application of six tags and set of rules covering their use. Tags are:

Release Order — Pink tag with deep blue printing.

Release Notice — Red tag with black printing.

Release Permit — Thin yellow paper with black printing.

Caution Order — White tag with red printing.

Operating Permit — Green tag with black printing.

Construction Order — Blue tag with black printing.

The first three listed actually function as one tag and the last one being used for construction really leaves only three types of tags for system operation. The colors were chosen after tests for color blindness and color selection had been given to employees.

The tags are shipping label style, about three by six inches. Each has a string for attaching to equipment. When tags must be attached to energized electrical equipment, such as knife-blade disconnects, standard insulated tag holders attachable by a disconnect stick are provided. In some cases, tag holders are permanently attached to the operating rods of equipment. The use of wire or any means other than those provided for attaching tags is prohibited.

Space is provided on each Release tag for recording a Release Number, the station name, date, time, line or equipment covered, person to whom issued, person placing, person ordering, and reason for placing. A brief

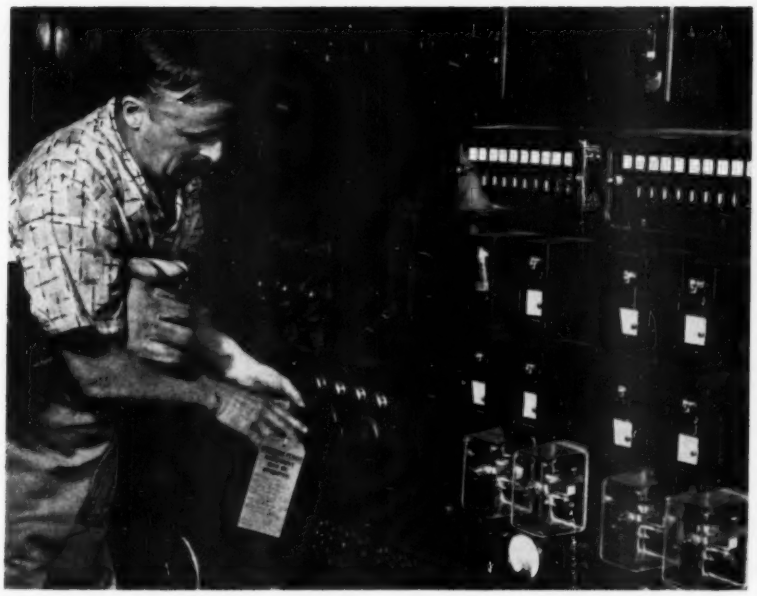


Fig. 2. When tagged with this operating permit, breaker may be operated when it is out of service

Well for West Penn

By T. C. MONTGOMERY
Chief System Dispatcher
West Penn Power Company

summary of the rules covering its use is printed on the back of each tag. All tags must be completely filled out before being placed, except under certain emergency conditions specified in the tagging instructions.

The author described these tags recently before the Systems Operation Committee of the Pennsylvania Electric Association, then gave the following comments on their use.

Release Order (Pink)

The tag used to protect men at work on de-energized lines or equipment is known as the Release Order. The word release was adopted from the thought "a line is released from service." Lines or equipment covered by this tag are said to be released from service and the persons working under it are said to have obtained a release. These terms are used instead of the more common term "Clearance", to avoid confusion with the universally used expression "Report Clear", which means that work is completed and the equipment may be returned to service.

The Release Order shall never be issued on any energized line or equipment, and lines or equipment upon which Release Tags alone are placed shall never be energized or operated by any person until all persons holding releases have reported clear. The word energized, as used in the tagging system, refers to any electrical or mechanical force, including steam, air, water, or gas, which might be dangerous to persons coming into contact with it. A release on electrical equipment shall not be issued until a visible opening has been provided to each possible source of energy, and all such openings have been properly checked and tagged, regardless of their location or their position during normal operation. For example, one opening may be within few feet of work area, while other is 20 miles out on a line. Both must be checked and tagged.

As the Release Order is used only to protect men at work, the individual to whom the Release is issued must report clear when not working, even though his work has not been completed and the line or equipment is not available for service. Each Release is issued to one person only who, until he reports clear, is responsible for the safety of all persons working under his supervision. If a second person wants to work on the same equipment and cannot work under the first person, he must obtain an entirely separate Release in his own name. No person may delegate any other person to obtain a Release for him or to report clear for him, and a Release that is issued cannot, under any conditions, be transferred. If the holder of a Release desires to leave his work and have it continued by another person he must report clear and other person must have new Release issued to him.

The only exception to this rule is when equipment is to be removed from service for work over an extended period of time, and someone working in a position which continuously succeeds itself may hold the Release issued in the name of the position, such as a shift electrician in a power station. The person on duty in such a position assumes all responsibilities, exactly as if the Release were issued in his own name.

Release Notice (Red)

Switching for a Release at a station usually requires placing several tags, and, if only Release Orders were used, the amount of writing required would become burdensome. To eliminate this, an auxiliary tag known as the Release Notice is used at all points except the master control point of a line at each station or the master control point of equipment in a station. This tag requires only the recording of the number of the Release, the station name, person to whom the Release is issued and the equipment to which it is attached.

The Release Notice is never used alone. It must be used only with the Release Order, which is attached to the master control point, such as a breaker control switch or a main valve to a boiler.

As a check that the equipment is properly covered by Release Notices, there is a space on the back of the Release Order in which the operator indicates each point to which a Release Notice is attached, the total number attached and the fact that they are removed before the equipment is returned to service.

Release Permit (Yellow)

When a Release is issued on station equipment at attended stations, a receipt is given as an additional check to the person obtaining the Release. This indicates the equipment upon which he may work. The receipt, known as the Release Permit, must be signed and turned over to the operator when reporting clear. It is a duplicate of the front of the Release Order and is printed on thin paper with a gummed edge by which it can be attached to the Release Order, and the two filled out at one time with carbon paper. This not only reduces the amount of writing required, but ensures that the Release

Permit will be an exact copy of the Release Order. Space is provided on the back of the Release Permit in which the person reporting clear states the equipment condition and signs his name.

As an additional safety precaution at attended stations, the person obtaining the release to work on station equipment must accompany the operator performing the switching and check each operation, and shall be jointly responsible with the operator for the proper execution of the switching. It is the responsibility of the operator to see that this rule is enforced. If switching is performed before the person taking the Release arrives, he shall go with the operator and check that all switching and tagging has been properly performed before the Release is issued to him. This rule applies to all other safety tags in the station and also in returning equipment to service.

Caution Order (White)

The purpose of the Release is to protect persons at work, and to make it as effective as possible it is limited to this one use. A separate tag, known as the Caution Order, is used to indicate abnormal conditions such as failures, hazards, or temporary changes in operating rules. This tag may be placed on either energized or de-energized equipment and may be issued either to a person or simply to designate an operating condition.

The Caution Order is issued to a person at his request when he is working near energized lines or equipment and might accidentally contact the line with a foreign object and foul the conductors. The Caution Order is not used to protect individual, but to protect equipment from being re-energized if a foreign object falls or swings into it during such operations as trimming trees, setting poles near an energized line, certain types of hot-line work, or connection of equipment to energized circuits.

Equipment on which a Caution Order is placed may be operated only upon a direct order from the load dispatcher. A Caution Order issued to a person, therefore, does not authorize him to operate the equipment, nor does it protect him from operation on energizing of the equipment, except when breakers trip automatically as mentioned. When a Caution Order is placed to cover any condition, it may not be removed and the equipment may not be returned to normal operation except with the approval of the Load Dispatcher.

A Caution Order is attached to the switchboard control of a breaker while disconnects are being operated in the circuit controlled by the breaker. This tag not only protects the operator from operation of the breaker by another person, but also directs his attention to the proper control switch upon his return to the switchboard.

Fig. 3. Shows a switching station operator using a switch stick to hang a Release Notice on disconnect

Operating Permit (Green)

One of the fundamental rules of the operating department is that no equipment be operated by any person other than the operator authorized to do so, and that neither this operator nor any other person may operate equipment upon which persons are working. Both Release Order and Caution Order definitely forbid this.

Since it is desirable that persons working on equipment be authorized to operate it under certain conditions, such as testing relays or checking a breaker during inspection, a means is necessary to authorize such operation and designate the equipment which may be operated. The tag used for this purpose is known as the Operating Permit. Its sole purpose is to permit the operation and is only tag that authorizes such operation.

The Operating Permit may be placed on either energized or de-energized equipment, and either alone or with a Release. It is used alone to permit operation when the equipment is not necessarily de-energized and with the Release when the equipment must be de-energized while being operated. When used with a Release, the Operating Permit does not authorize any operation which would energize the equipment or any line or equipment controlled by it.

Equipment to which an Operating Permit is attached may be operated only by or under personal direction of the person to whom it is issued, but this person is restricted only by the rules that no person except the operator may operate equipment from a switchboard and that no released equipment will be energized.

Construction Order (Blue)

During construction work there are times when work is being performed on new or removed equipment which is in the vicinity of equipment in operation. Although normal operating rules cannot be applied to such work, it is necessary to designate the equipment under construction in order to prevent men working on the wrong equipment by mistake. The tag used for this purpose, known as the Construction Order, is really not an operating tag but is intended for use by construction organizations that may not be familiar with the operating and safety rules. A Construction Order will not be issued unless the equipment involved is isolated from all possible sources of power by an opening other than the

normal isolating equipment. This means, for example, that when the final leads are connected to a breaker, or a set of disconnects to a live bus, the Construction Order is no longer effective and a Release must be obtained for any further work. The placing of a Construction Order removes the equipment from normal jurisdiction of the operating organization and permits the construction men to work on, move, operate, or energize the equipment at will with the restriction that they may not energize it from the system or operate it from a switchboard in service.

Dispatcher's File

As an additional check the Load Dispatcher enters on a file card the release numbers or caution numbers, name of person to whom issued, time reported on and time reported clear. This card is kept on the dispatcher's desk until all persons have reported clear and the line or equipment has been returned to service.

Each station operator involved also records similar data in his log.

Supervision

Maximum safety can be obtained under any tagging system only when it is supervised by some person in authority. The system described is supervised by the system operating department, which designs the tags and issues the rules covering their use. General authority over the application of the system is given to the load dispatcher and, with certain stated exceptions, no tags may be placed without his permission.

Direct supervision of switching and tagging by the load dispatcher is required on all lines of 20-kv or over, and on all lines of any voltage which have more than one source of power. Station operators may be, and usually are, authorized by the load dispatcher to perform switching and issue tags without supervision, on equipment in their station and on lines of less than 20-kv which can be energized only from their station. The chief engineer of a power station, or a person authorized by him, assumes the duties of a load dispatcher in supervising and tagging all equipment of less than 20-kv within the power station.

As a check on proper authorization for placing tags, a separate number is issued to cover each Release, Caution Order, and Operating Permit. Number is issued by Load Dispatcher and recorded on each tag used.

Safety Factors

An important factor in the success of a tagging system is a carefully worked out routine for issuing switching orders and receiving reports. On the West Penn system, all persons who issue orders or give reports are required to use a standard terminology which may be varied only as required by local conditions. Authorized equipment names must be used and these must be checked with the equipment signs before an order is executed. No order is effective and no report is accepted until it has been repeated exactly as heard and approved by the phrase "That is right".

Another important safety factor is a means of making certain that only capable persons perform switching and work on the West Penn system. An eligibility system is maintained consisting of a card index listing the name of each authorized employee, the class of switching or work he may perform and any territory to which he is limited. No person may perform switching or have any operating tag issued to him unless his name is placed on the eligibility list after passing a course of training by an Operating Instructor. The system is made more effective by including its classifications in various job qualifications, so that training and approval is necessary for advancement.

West Penn's tagging system, as stated before, has been in use for over 25 years, with only minor revisions. During this period there have been no accidents or errors because of failure or inadequacy of the system itself. There have been operating errors due to failures such as improper placing of tags, but even these amounted to less than 2 per cent of all errors.

An extremely important factor in the success of this or any other tagging system is full cooperation of all persons concerned with its application. Unless each person has full confidence in the word of others, protected as much as possible by checks, it will surely fail.

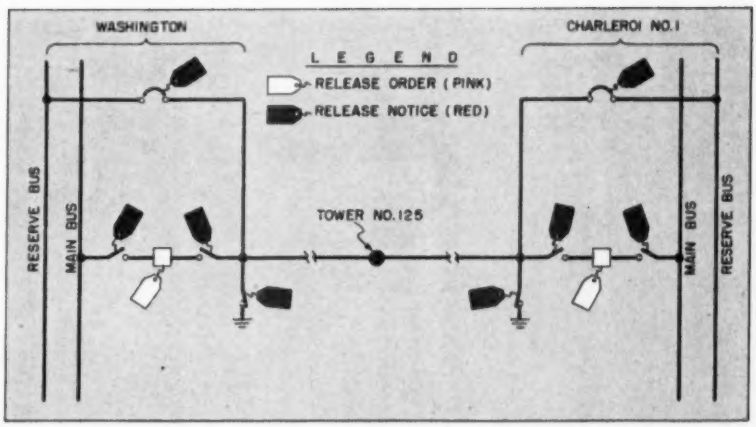


Fig. 4. A single-line diagram showing 132-kv line between Washington and Charleroi No. 1 stations and the switchgear at each station with tags which must be in position before work is permitted on line

How System Works

The actual application of the system just described can probably be best shown by an example of its use.

Let us assume that a 132-kv line between Washington and Charleroi stations, named "Washington-Charleroi No. 1" is to be removed from service for Line Foreman John Smith's crew to replace a string of insulators at Tower 125.

Before the scheduled time, the Load Dispatcher will have given to each station operator the Release number, person's name and reason for the Release, so they can prepare the required tags in advance. Each operator will have filled out one Release Order, to be attached to the breaker control switch, and four Release Notices, one each to be attached to the operating levers of the breaker disconnects, line grounding device and reserve bus air-switch.

At the scheduled time John Smith will call the Load Dispatcher and report ready for the Release. The dispatcher will then call each station and advise the operators that he is ready to remove the line from service.

With both operators and if possible, the foreman, held on the phone circuit, the dispatcher will order Charleroi to "Open the Washington No. 1 — 132-kv breaker at Charleroi". The operator will repeat the order as heard and, upon hearing the dispatcher say "That is right" will open the breaker and attach a blank Caution Order to its switchboard control switch. Operator then repeats "Washington No. 1 — 132-kv breaker at Charleroi open at 3:02 PM", listens for dispatcher's repeat and give the approval phrase "That is right".

The dispatcher then follows the same procedure to open the Charleroi No. 1 breaker at Washington, de-energizing the line.

Since both stations have full-time operators who are thoroughly familiar with the switching procedure, the dispatcher will then simply order each to "Place Release No. 758 for John Smith on the Washington Charleroi No. 1 — 132-kv line". Each operator will then proceed to open the breaker control circuit at the switchboard, observe the equipment sign on the breaker, check the breaker open by its target and by operating the mechanical trip, open the disconnects and attach a Release Notice to the operating lever, check the reserve bus airswitch open and attach a Release Notice to its operating lever, check the line de-energized by the "Glowtector", and if found de-

(*Continued on page 112*)

Fig. 1. Tractor and scraper hauling, spreading and compacting coal for storage. Note the way scraper sides have been extended for increased capacity

How Consolidated Edison Packs and Seals Coal Piles

Unprotected coal in outdoor storage gets wet, causing it to hang up in bunkers; it catches fire by spontaneous combustion; and when dry blows away and becomes a public nuisance. This article describes a method of compacting and sealing reserve coal piles which prevents such troubles in Consolidated's pile

PROTECTION of outdoor coal and storage against moisture, fire and dusting has long been a problem for coal-burning power stations. In the last 10 or 15 years many have developed methods, now widely and effectively used, of compacting the coal to drive out the air, then sealing the surface of the pile to keep out air and moisture. This is particularly important for reserve stockpiles, which may remain untouched for months at a time. Such a situation is well illustrated by the successful procedure of Consolidated Edison Company Inc., of New York, as described below.

Most of the company's coal is delivered direct to their generating stations; but to assure continued supplies in spite of strikes and transportation troubles, they have established a coal stockpile of nearly 2,000,000 tons as a reserve for all their stations. It is located near the new Astoria generating station, now under construction, and is shown in Fig. 2.

Their method is to compact the coal with tractors, then spray the finished pile surface with tar obtained as a by-product from their gas plants. Only the reserve storage is treated this way, and not the normal station stocks which are turned over frequently. The method is suitable for any type of coal and any size of coal pile, and the tar does not affect pulverizing or combustion.

Here are details of the whole operation, including the way they reclaim coal from storage in vertical slices instead of the former method of stripping it off in horizontal layers. First step in the operation is to build up the coal pile by the following methods.

To begin building up the pile, the

Fig. 2. Nearly 2,000,000 tons of coal shown here in Consolidated Edison's main reserve stockpiles

storage area is first levelled and covered with a layer of coal. Then a tractor makes a couple of passes over the whole layer to compact it, after which the layer is 12 to 18 in. thick. Then another layer is added and compacted to the same thickness, and the process, layer by layer, is repeated until the whole pile is 45 to 50 ft high, with 45 deg sloping sides. A ramp for the tractors to get up and down is cut into each pile. On the large ones, two ramps are used for one-way traffic.

For storage under the loading bridges, coal is unloaded from barges by grab bucket, carried by belt conveyor to the bridges, from which it is dumped, then spread and compacted by tractor.

As Fig. 1 shows, the area under the bridges is too small for much storage, so most of the coal has to be piled on the remaining open ground. From the barges it is dumped under a bridge in a temporary pile, picked up by scrapers, and taken to the permanent storage area, where the piles are built as above, both tractors and scrapers being used for compaction, as shown in Fig. 1.

Preparing for Sealing

The top is smoothed and given a 1 in 50 ft slope towards a gully cut in one side of the pile. The gully is lined with a piece of ordinary conveyor belting. Both gully and belting are necessary to prevent rainwater cutting the pile on its way down.

The sides of the pile are smoothed with an iron roller. A tractor, standing on top of the pile, raises and lowers the roller with its winch cable. The roller is about 6 ft long by 3 ft diam and can be filled with water to match its weight to the type of coal being rolled.

A separate pile is made for each kind of coal; the largest holds about 250,000 tons.

Protective Coating

When the whole surface has been smoothed, the top and sides of the pile are sealed with a coating of tar. This tar is a by-product from condensers used in coal gas production. When it comes from the condensers it contains about 50 per cent water by volume, which is reduced to 25 per cent for coating coal. The tar is carried to the coal pile in an ordinary tank truck, into which it is put at a temperature of 180 F. The tank has a small gear pump, connected to a 1 in. rubber hose ending in a flattened metal tube. With a pumping pressure of 35 to 40 psi the tar comes out of the flattened tube in a fine spray, which is built up to form a penetrating layer, ½ to ¾ in. thick, over the whole pile.

Spraying the Tar

About 2 gallons of tar per sq yd are needed, though this will vary with the kind of coal. Coarse coal takes more tar than fine.

Fig. 3. How shovels and trucks take slice from the coal pile. Afterwards the vertical face is resealed

A man holds the flattened tube and sprays the tar evenly over the coal surface, walking beside the truck as it moves across the pile. The top surface and upper halves of the sides are sprayed from the top of the pile; the rest is done from the ground.

Maintaining the Coating

As long as the coating is intact, water cannot get to the coal to spoil it; air cannot reach it and cause spontaneous combustion, and there is no dust to blow away. But the coating has to be inspected frequently, as rain, wind, and settling sometimes damage it. When this happens, the damaged part is resealed with tar.

Reclaiming the Coal

The company used to reclaim coal from storage by stripping it off the piles in horizontal layers and resealing what was left. Now, however, they reclaim it in vertical slices with power shovels working off the ground, as shown in Fig. 3. With this method only the vertical face has to be resealed; the rest of the pile remains intact under its tar roof.

Fire Extinguisher Popularity Poll

CARBON DIOXIDE, dry chemical and plain water enjoy the widest popularity of all types of portable fire extinguishers, according to the National Fire Protection Association.

Plain water extinguishers are preferred for a Class A fire. They can be either of pump or pressurized gas cartridge type. While pump-type portables are somewhat lighter and less costly to produce, the gas cartridge variety is far easier to operate and has a more effective range.

In the past carbon dioxide and foam have been favored for Class B fires, but recently dry chemical has gained wide acceptance. Tests by the Factory Mutual Laboratories indicate that the dry chemical extinguisher has superior performance in conventional portable extinguishers.

For Class C fires the carbon dioxide type is probably the most effective. The dry chemical extinguisher is also suitable, but on certain types of electrical equipment it may be difficult to clean away resulting powder residues.

Although fire extinguishing ability was the prime consideration in choice of extinguishing agents, those which leave no residue and produce no damage are to be preferred. In regard to the use of carbon dioxide or dry chemical for Class B and C fires, it is the general conclusion that carbon dioxide is best suited for indoor use and dry chemical for outdoor use.

CLASS A, or ordinary fires, are fires in paper, wood, coal or similar materials. Materials themselves do not actually burn, but when heated too much, gases are driven off which do burn. Cooling the material to prevent formation of gases stops the fire.

CLASS B fires are those of flammable liquids and gases, put out by smothering. Extinguishers which contain materials to cover these fires are used.

CLASS C fires are electrical. Extinguisher systems which are nonconductors are provided to cope with these fires.

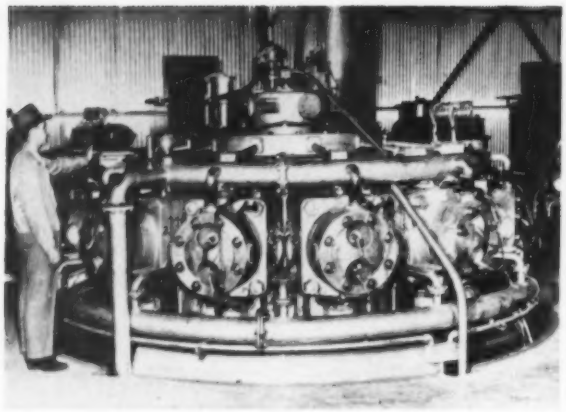


Fig. 1. One of the 12-cylinder radial engines installed at Alcoa's plant at Point Comfort, Texas; this is one of a group of 74 engines; they burn gas as fuel

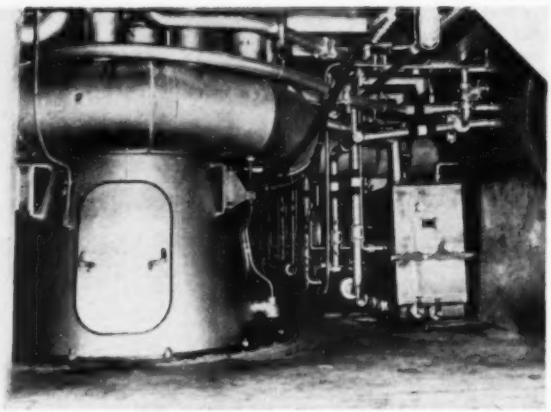


Fig. 2. View of Fig. 1 engine showing steel subbase, exhaust header, water pumps and lube oil sump tanks. Engine and upper base can be delivered by truck

How to Maintain Radial Engines

Details of maintenance procedures set up on the basis of experience with 120 radial engines at Port Comfort, 80 at Chalmette. Engine construction and details of restraining linkage are described. Schedules for 120-day and yearly inspections and maintenance. Organization of maintenance

MOST OF the present producers of aluminum are finding it economical to generate their own electric power for operation of aluminum potlines, as explained in the article Aluminum Producers Get Low-Cost Radial Engine Power, April issue, page 80. These include Aluminum Company of America, Reynolds Metals Company and Kaiser Aluminum & Chemical Corporation.

Accordingly, at various plants in the Gulf Coast area of the United States, these companies have made very large installations of Nordberg gas-burning radial engine-generator units. Notable are the 194 radial engines of 1500-kw capacity each at the Alcoa plant at Port Lavaca, Texas, and the 80 units at the Kaiser plant at Chalmette, La. Design of the radial engine generators was explained recently before the AIM & ME by R. W. Bayerlein of Nordberg Mfg. Co. and his data on installation, operating and maintenance costs were given in the above article in the April issue.

Engine Details

The following data outline the maintenance procedure recommended for these radial engines. To understand it better, consider first some of the details of the engine's construction.

Figure 1 shows a closeup of one of 74 twelve-cylinder radial engines recently installed as an addition to the 120 radial engines at Alcoa's Point Comfort reduction plant. The engine is installed at floor level with its base and direct-connected generator located immediately below it at the basement level. Figure 2 shows the lower steel subbase, exhaust header, water pumps and lube oil sump tanks in this arrangement. Net weight of the complete engine with upper steel base is 79,000 lb. This weight, coupled with the small engine dimensions, permits shipping a completely factory-assembled engine to the site, reduces installation time as well as cost. Cylinder heads, pistons, upper and lower main bearings, as well as several other integral parts, are made of aluminum.

The engine is installed with the axis of the crankshaft vertical, with the single crank at the top. The crankshaft is made of high tensile alloy cast iron. Cylinders, equally spaced radially about the shaft in a horizontal plane, are bolted to the frame. Aluminum pistons are of the trunk type. All connecting rods of steel forgings are identical. The main frame is a single casting with a central hub which houses the lower aluminum crankshaft main bearing bushing and the steel babbitted Kingsbury type of self-aligning thrust bearing, which carries the weight of the crankshaft and generator rotor. The upper aluminum crankshaft bearing bushing is located in the cover, which is bolted to the frame. Mounted on top of the cover are the governor, distributor and gas valve operating mechanism.

Restraining Mechanism

In all radial engines, rotation of the crankpin bearing must be prevented in order to obtain constrained motion of the connecting rod crank end. This problem is solved with two patented restraining mechanisms. The geared mechanism used in the 11-cylinder engine has been described before, but the restraining linkage used on the 12-cylinder radial engine has not been generally discusssed. This linkage assembly is shown diagrammatically in Fig. 4.

Figure 3 shows the linkage as installed in the 12-cylinder engine. Balance is achieved by actual convergence of combustion pressures and inertia forces at one focal point on the crankshaft axis. The inner ends of the connecting rod are secured by knuckle pins equally spaced around the master bearing mounted on the crank pin. Reciprocating motion of each piston is translated into rotary motion at the crankshaft through the

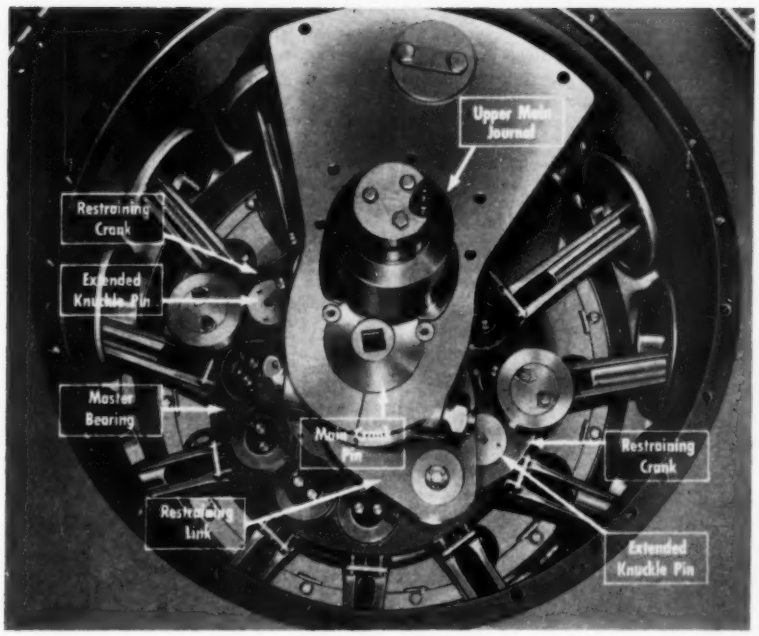


Fig. 3. View of parts of 12-cylinder radial engine, showing restraining linkage installed; see text

connecting rods and master bearings. The master bearing is restrained from rotating by this constrained linkage assembly, which makes the master bearing gyrate bodily with the crankpin. This linkage, however, does not in any way restrain the basic crank motion of the engine mechanism.

Since the center of the master bearing is moving along a circular path, every point on the bearing moves along circles of equal diameters. Therefore, the knuckle pins, which correspond to crankpins in the connecting rod-crank mechanism, describe identical circles, thus making the moving parts of every cylinder kinematically identical. As a result, interchangeable parts can be used in all cylinders and the timing of the engine is greatly simplified and identical for all cylinders.

How Maintenance Is Scheduled

With these details in mind, let us consider the maintenance problems on these engines, on the basis of experience with this engine in two large aluminum plants. Kaiser's Chalmette plant of 80 engines has been in operation approximately 1 year and Alcoa's 120 engines at Point Comfort have been operating since 1949. This experience indicates the following maintenance schedule.

A rather strict preventive maintenance schedule has been found most desirable. This program involves the engine and all auxiliary equipment, both electrical and mechanical, associated with the engine. A schedule is set up on a periodic basis, using calendar days or engine hours, as the case may be.

Items for 120-Day Inspection

Every 120 days, or approximately 3000 hours, a superficial inspection of the engine and a rather complete one of the electrical equipment is made.

The following are the major items usually included in this inspection:

1. Checking d-c brush length and replacing brushes where required
2. Cleaning of the commutators and the slip rings of the armatures
3. Cleaning electrical contactors, relays, etc.
4. Checking operation of protective and shut-down devices, both electrical and mechanical
5. Tightening all engine bolts, pipe flange connections, exhaust heater connections, etc.
6. Replace leaking gaskets, washers, etc.
7. Perform any other repair or maintenance item that has been previously reported for that particular unit

Items for Yearly Inspection

Approximately once a year, the following additional items are inspected and serviced:

1. Governors
2. Check ignition distributor points, reset points, check ignition transformer oil level
3. Remove and regap spark plugs
4. Lubricate auxiliary motor bearings

Approximately at 2½ to 3 year intervals, it is necessary to partially disassemble the engine to check compression rings and replace the top two compression rings. At the same time, check is made on bearing clearances, gear wear, and general appearance of inside of engine; however, the main crank and the lower main bearing and thrust shoes are not checked at this time.

Experience indicates that the wear in the cylinder is only about 0.00025 in. to 0.0005 in. on the diameter per 1000 hours of operation. Therefore a rebore job or cylinder renewal would not be required for possibly 10 or 15 years of operation. Of course, proper lubrication and oil filtration is a necessity.

Maintenance Crews

The routine 120-day inspection is performed by a definite crew. The service schedule is set up in advance so that all people concerned, both in operating and maintenance, know each day which engine will be down and can plan their work accordingly.

Each crew consists of an electrician, a mechanic, a pipe fitter, and two helpers. This crew is not occupied the entire day on routine inspections at all times; however, it is necessary to maintain this number of men in a crew in order to assure that they will always be able to finish the routine work on the particular engine. The yearly inspection items are merely added to the 120-day inspection at the proper interval and this work is taken care of by the regular crew.

At Alcoa, the engine disassembly involving piston ring replacements is performed by special crews. These crews normally consist of three men; that is, two craftsmen and one helper. They are able to complete the disassembly of an engine, check all clearances, clean pistons, install new rings as required and reassemble the engine in 32 hours.

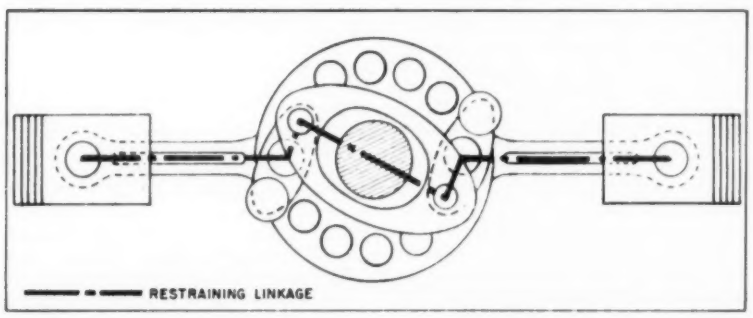


Fig. 4. Diagram showing principle of restraining linkage as employed on 12-cylinder radial engine

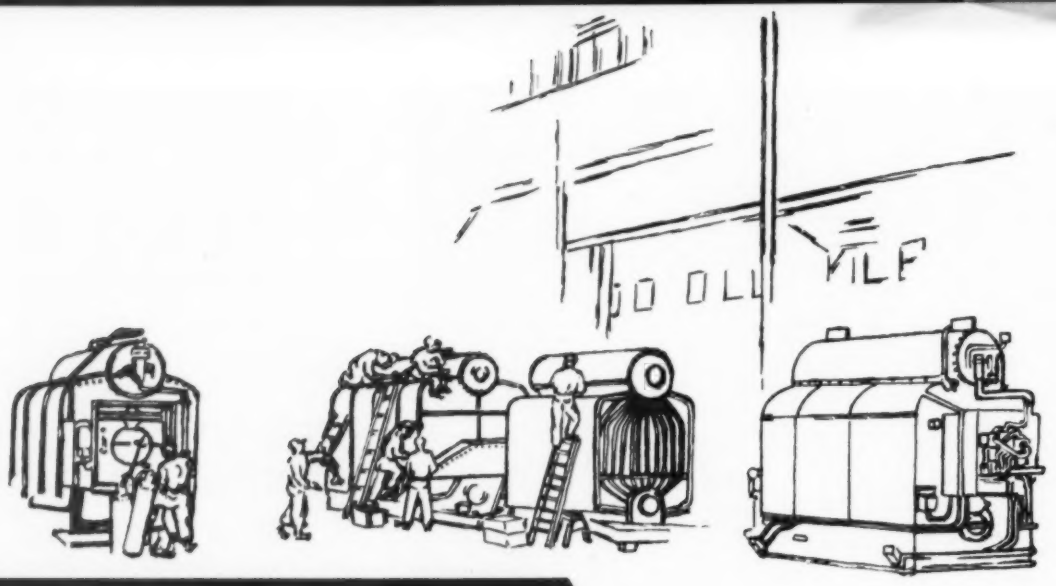


Fig. 1. Most package water-tube boilers leave the shop ready to use after a few simple connections

STEAM. . . .

in Water-Tube Packages

Although large steam generators grow larger, small or in-between steam user has found that the package water-tube boiler will give him steam where he wants it, when he wants it, without waste

THERE ARE TWO significant trends in the manufacture and use of modern-day steam generating units. Both are important, and both have a definite scope.

Topsy-like, large modern steam generators just grow and grow. One definite trend is to larger boilers — and fewer of them. Pressures of 1800 psi, temperatures of more than 1000 F, and production of more than 1,000,000 lb of steam per hr by these behemoths is becoming commonplace. Primarily confined to central stations of sizable utility systems or to very large industrial power plants, this growth is attributable to the increased demand for steam and the never-ending search for higher efficiency.

Trend to the "Package"

There is another trend of equal importance however, although perhaps not so glamorous. In contrast to the development of giant steam generators, it has involved the tailoring of efficient, reliable equipment to specific steam requirements. The result has been that the small, or special, steam user has steam where he wants it, when he wants it and without waste, and at a cost and efficiency commensurate with his need. This trend is typified by the so-called ackage steam generator.

What Is Package Unit?

What is a *package* steam generator? The term has been applied haphazardly to a variety of boilers during the past 20 years. For this reason, both fire-tube *and* water-tube type boilers have acquired the connotation.

For example, some advantages common to water-tube boilers long have been: less weight per given size; rapid steaming; safety; higher pressures possible; better expansion and contraction possibilities; ease of accessibility; efficiency; and, responsiveness to overloads. Fire-tube boilers, on the other hand, have these advantages: low initial cost; compactness; small floor space requirements; little or no settings; and, factory assembly.

It is fairly obvious, then, that the package water-tube steam generator not only retains the major advantages of the conventional type water-tube boiler; but, in addition, incorporates most of the important advantages of the fire-tube units. Notably, package water-tube boilers have become compact, require small floor space and are factory assembled. These advantages can be more specifically singled out in listing the general characteristics of a package unit.

By way of definition this article will confine itself strictly to a discussion of the features and applications of *water-tube* package steam generators. Fire-tube package boilers will be discussed in some future issue of POWER ENGINEERING.

Defining Features

In any event the term package, as applied to water-tube boilers, is given some definition by certain characteristics distinguishing such units from others. In general, these common characteristics are:

Assembly — All package water-tube boilers are for the most part shop-assembled, as shown in Fig. 1. Many of them are completely shop-assembled. One manufacturer ships an entirely self-contained unit, already assembled, which includes boiler proper, burner, forced-draft fan, feedwater regulator, valves, soot blower, refractory, insulation, and other accessory equipment. This is the rule rather than the exception with package units. Most steam gen-

erators can also be shipped directly from the factory knocked-down into easily fabricated components, if the situation demands it.

Steam Range — Nearly all package units fall within a steam capacity range of between 500 to 30,000 lb of steam per hr. Individual boilers will usually give satisfactory results between full and one-third of full load, and these unit ranges are increasing. Pressures may go as high as 900 psi, or as low as 5 psi.

Shipping — Closely linked with shop assembly is the ease of shipment. These units, in most cases, can be shipped very conveniently by common carrier—rail or truck (see Fig. 2). The only limitations to such shipments are the laws of some states which set low maximum tonnages permissible on state highways. Shipping weights of package water-tube steam generators range anywhere from 1 ton to more than 42 tons.

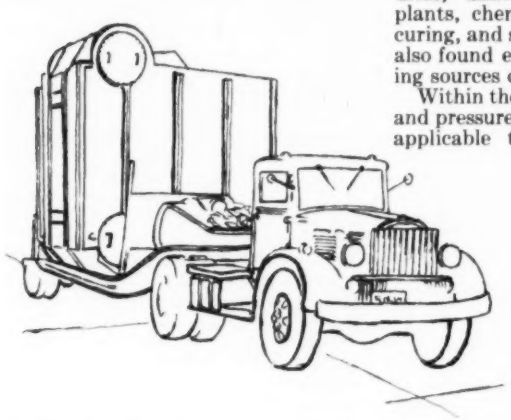


Fig. 2. Package units can be shipped conveniently by common carrier — air, rail or truck

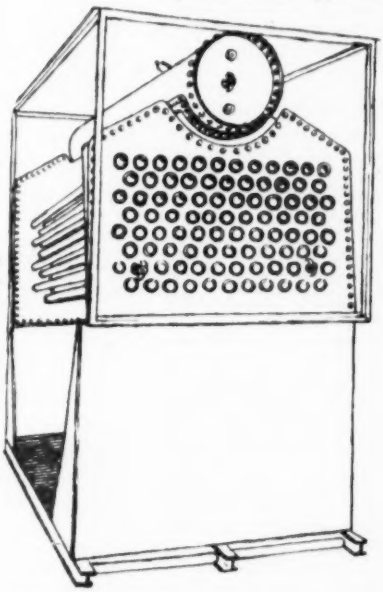


Fig. 3. This boiler is typical of those in Group I and is built in sizes up to 200 hp, 125 psi

Installation — Installation of the units is relatively simple. Foundations are either not required or consist of very simple design and construction. Many of the smaller package generators come with permanent steel bases, or legs.

Fuel, water, electricity and steam are four basic connections necessary to prepare most units for operation. Additional requirements include stack or breeching connections, blowdown, pumping and heating units, vents, or forced-draft equipment—depending upon the particular unit. In nearly all cases the units can be put into productive operation in a very short time—often less than one day.

Size — One of the most important characteristics of package boilers, necessarily, is their size. The factor most generally responsible for the development and widespread use of package units is the large quantity of quality steam they are able to produce while occupying a limited space. Head room is the most important of dimensions, and no strictly package unit is more than 17-ft high. More often, they range from approximately 6 ft to 13 ft in height.

Length and width vary much more widely. The longest package units shipped reach nearly 30 ft in length. Capacity of some units is often added by the addition to the length only. Widths may be as much as 12 or 13 ft. Floor space required for most units will almost never be greater than 350 sq ft.

Uses — The smaller, more compact package boilers have an infinite variety of applications to which they are exceptionally well suited. There are some specific uses, however, which stand out as especially practical. Notable among these are use in small or moderately-sized power plants, institutions (hotels, schools, hospitals, etc.) and small industry for production of power; and for special services or adaptations in production of process steam in laundries, dairies, paper mills, textile plants, chemicals, plastics, concrete curing, and similar places. They have also found extensive service as heating sources on railroads.

Within the limits of their capacities and pressures these package units are applicable to nearly any heating, process steam or power requirement. An interesting application has been their use to supply supplementary process steam in small amounts between major production periods.

Certain factors, peculiar to this type of steam generating unit, promise their increasing use, particularly in some situations. They are: (1) where steam is required in remote places; (2) where demands for steam are intermittent; (3) where capacities of existing equipment may not be great enough to handle emergency or peak loads; (4) where steam load is fluctuating and may involve sudden heavy demands; (5) where automatic operation and a minimum of attention is desirable; and, (6) where space, or available space per required steam output, may be a serious problem.

Steam generators possessing all of these qualities of assembly, steam range, installation, size and use in some degree, can in nearly all cases be classified as package units. Because of the large number of manufacturers now engaged in producing package boilers, different production techniques and design details, there is necessarily a slight divergence of conformity to such arbitrary specifications.

General Features

Several other features not commonly found in larger, field-erected steam generators are to a certain extent characteristic of package units. One of these is the wide latitude of use, with respect to indoor or outdoor, to which these units can be put without extensive — or, in some cases, no — sheltering. Many models are equally as reliable and efficient installed outdoors or semi-outdoors. Most have weather-resistant casings, and in a few instances sheltered instrumentation. Usually, however, principal electrical equipment requires some type of housing, and some protection must be provided to prevent freezing of certain equipment before outdoor installation.

Size and construction naturally provide a greater ease of and relative freedom from maintenance. Maintenance is almost nil on some of the very smallest units, while whatever regular or emergency maintenance necessary on them, and the larger units, is in most cases speedily accomplished. Many of the package boilers are provided with easily removable plates on the casing sides. Those boilers which do not have this feature provide large handholes and doors for rapid access to critical parts. Water walls on many models serve to reduce maintenance. Soot

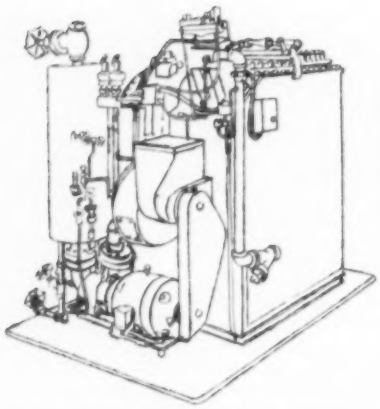


Fig. 4. Forerunner of this package unit, Group II, was originally designed for diesel train heating

blowers, which are standard equipment in some units, keep tube repair low. Other maintenance aids incorporated into the design of some package boilers include: hinged windboxes and burners; forced circulation; inclined tubes; manholes in drums; conveniently placed valves, strainers, etc. The very nature of the package boiler's use requires that accessibility and ease of maintenance be mandatory.

Classification By Origin

No formal classification of package water-tube boilers exists. In fact, as suggested earlier, the term package itself has long been the victim of vague associations. However, it is possible to arbitrarily divide the various types of units manufactured today into somewhat loose groupings based upon their development. Three such groups suggest themselves.

Group I could well consist of boilers (Fig. 3), generally from 500 to 5000 lb of steam per hr capacity, of standard water-tube types manufactured for many years and now being equipped and installed as package units.

Group II is made up of package steam generators originally designed for some definite application, but now found to be suitable or adaptable with little or no change to nearly all uses characteristic of package units (Fig. 4). An example of this group is the development and subsequent widespread use of steam generators originally utilized on railroads for train heating. Most of these units are also in the 500 to 5000 lb of steam per hr range.

Group III consists of boilers which most nearly resemble the huge water-tube steam generators of today in many respects, except size (Fig. 5). Most of these units are built with the same specifications, materials and techniques as the larger units. Steam range is generally from 5000 to 30,000 lb of steam per hr. Chronologically, this group was last on the scene.

All three groups fulfill a definite need of industry and the small power or steam user. Certain traits of the various types fit them to the equally various uses to which they are best suited.

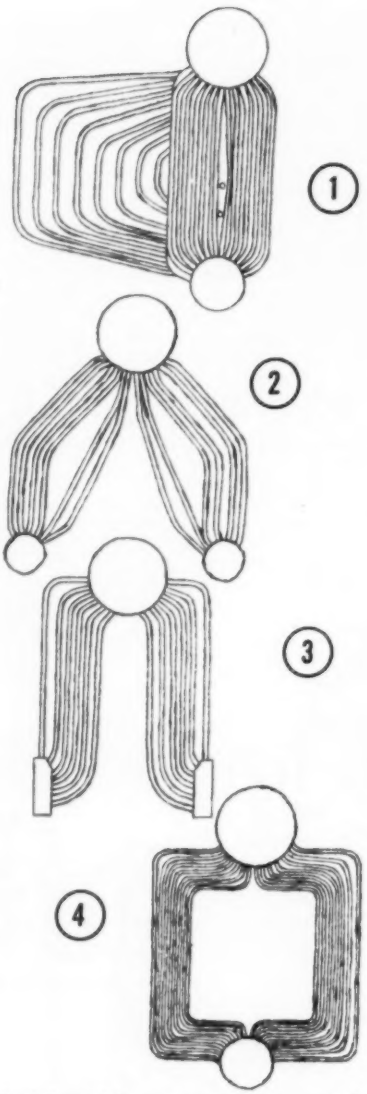


Fig. 6. Some of the more common arrangements of tubes and heating surfaces in water-tube package boilers of Group III to assure the most economical fuel usage as well as dependable steam service

Group I

A typical boiler of *Group I*, as shown in Fig. 3, is available in standard sizes up to 300 hp, for working pressures of 100, 125 or 150 psi. Smaller boilers in this series are equipped with 2-in. tubes, larger ones with 3-in. tubes.

The units are steel, self-contained, and with most heating surface of straight, inclined tubes directly exposed to radiant heat of the fuel burned in the firebox or furnace. Rapid water circulation, plus three-pass contact of hot gases effects quick steaming and fast reaction to load change. This type can be equipped to burn coal, oil, gas or waste fuels or wood.

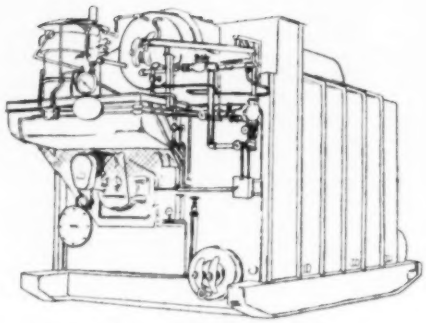


Fig. 5. This completely shop-assembled unit, Group III, will produce up to 30,000 lb of steam per hr

Several special settings, brick or integral steel base, are available, including settings designed for the burning of such fuels as industrial waste, wood chips, etc.

Group II

This group consists of package units specifically designed for certain purposes. Chief example is those units designed for application aboard diesel-electric locomotives to provide high-pressure steam for heating passenger trains, dining car steam tables, and to supply hot water. Design was restricted by sharp limitations on weight, space and electrical current used, while incorporating reliability and automatic operation.

A typical package unit of this type is built in several sizes, up to 5000 lb of steam per hr, with operating pressures up to 300 psi. Principal parts are heating elements, operating motor, feedwater pump and regulator, circulating pump, burner, fuel oil pump and air blower. Heating surface consists of a coil of radiant elements and cross-baffled convection elements. All are continuous lengths of 1½-in. tube. Each is connected to an inlet header and an outlet header.

A circulating pump, driven by a constant-speed motor, forces water at a velocity above that where scale-forming may take place. The outlet header is connected with a vertical drum or separator. Steam flows from the separator to the outside steam line.

A single burner is used for heavy oil or gas-fired units, while a large and smaller burner in tandem are used for lighter fuel oils. Air for combustion is supplied by blower and regulated by a damper controlled by fuel oil pressure; fuel oil pressure is controlled by steam pressure. This method of controlling output to demand, a form of a servo-mechanism, has been one of the most important steps in making the package boiler efficient and facile at all loads.

The feedwater pump, automatically controlled by a float-system in the separator, pumps feedwater to a closed heat exchanger for preheating. Feedwater then enters the outlet header and separator where it is deaerated.

Controls of simple construction are provided for regulating fuel, air and water (again in some cases done by some form of servo-mechanism). Blowdown is automatically controlled. The unit is equipped with push-button stop-and-start control and a complete set of safety devices.

Group III

This is the largest group, both in size of the units and the number of manufacturers engaged in construction. It is also a very important group for several reasons. Generally, everything found on large, highly engineered steam generators can be found on these smaller, standard counterparts. Forced circulation, water-cooled walls, soot blowers, efficient tube arrangement, superheat, reheat—all of these and more can be and are incorporated into most of these units.

Because they utilize to the fullest extent the knowledge and experience of manufacturers, these boilers come nearest to giving real meaning to the term package steam generator. Most of the boilers within this group fall within a capacity range of 3000 to 30,000 lb of steam per hr. Pressures may go as high as 900 psi—temperatures to 800 F.

These boilers vary in detail of design and construction as much as their larger twins. Fundamental differences, for ease of discussion, probably lie in the arrangement of furnaces and boiler heating surfaces to assure economical fuel usage and dependable steam service. Several tube arrangements are common, and some of these are shown in Fig. 6.

A discussion of the principal features common to *Group III* package steam generators is as follows:

Boiler Proper — Although arrangement of the furnace and heating surfaces vary, in most cases design of the remainder of the boiler proper of these units is similar. Nearly all of the boilers are enclosed in steel casings—some flanged, some welded—but all weather-tight, rugged and designed to allow for expansion and contraction. Some construction permits use of the pressurized furnace. Refractory and insulation invariably is used to line these casings. No complicated headers interfere with boiler circulation.

Bare water-cooled tubes forming side walls provide durability and high heat absorption at these locations, and water cooling of rear refractory walls gives added protection. Some units have downcomer tubes within the refractory and insulation. On one unit this provides clean water to the water walls and gives a continuous ring-like circulation.

Despite the larger size of these boilers compared to the smaller package units, settings range from none at all to simple concrete foundations. The use of stoker-fired coal, however, may make the setting more elaborate.

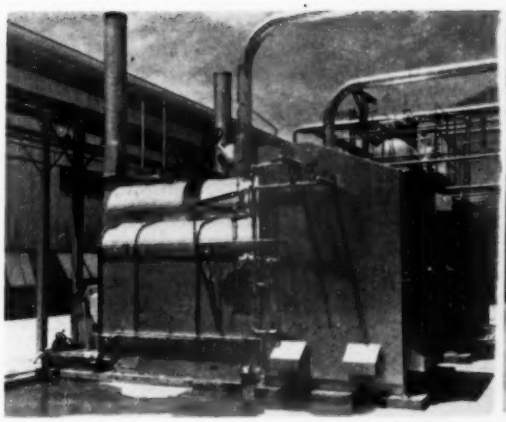


Fig. 7. Two 150-hp gas-fired package units placed outdoors at Reynold's Metals San Patricio Plant

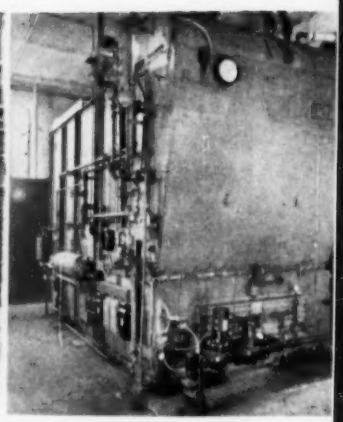


Fig. 8. Indoor installation of a combination gas- and oil-fired unit with maximum delivery of 250 hp

INSTALLATIONS

Combustion — All of these units can fire fuel oil or gas, or in most cases a combination of both. One such boiler is designed to fire heavy oil, heavy oil and gas, light oil, light oil and gas, natural gas, manufactured gas, or coke-oven gas—adequately demonstrating fuel versatility. To take advantage of price variations in fuel, or for other reasons, changeover from gas to oil or from oil to gas is rather easily accomplished, usually by mere manipulation of controls and valves. Many of these package boilers are also adaptable to utilization of any other standard method of firing—principally, the use of coal with underfeed or spreader stokers.

To fire oil many steam generators are equipped with rotary cup burners in smaller-size units while jet or mechanical-pressure burners are used at higher capacities. In one model two burners are used at the higher capacities. Ring burners are often used for gas firing.

Combustion air is furnished in a variety of ways—forced, induced, natural, or a combination of several or all of these drafts.

Furnace volumes and heating surface (area) depend, of course, upon the capacity of the unit; ranging as high as 900 cu ft and 3600 to 4000 sq ft, respectively, on certain models.

Controls — Most package boilers in this group are equipped with either fully automatic control or semi-automatic control. Fully automatic control usually includes ignition, starting procedures, maintaining of operation, and in many cases automatic restart. Push-button operated, this type of control is well-suited for installations where there is no full-time operator and for off-duty heating service where no operator is in attendance. Such control is adaptable to the addition of an indicating and recording panel, but, in any case, operating controls are factory-mounted on the steam generator.

Semi-automatic control, usually electronic, normally requires manual starting and is generally suited to the industrial user where close pressure regulation is necessary and steam loads fluctuate widely.

With either type of control most package boilers are so designed that the operator can take full manual control at any time he desires.

One manufacturer lists the sequence of fully automatic control as follows: (1) Forced draft fan, fuel oil

(*Continued on page 119*)

Table showing the results of tests on a typical water-tube package boiler, using distillate fuel

Results of Tests	*Test Number*				
	1	2	3	4	5
Test duration, hr	7.5	8.0	8.0	8.0	8.0
Steam pressure, psi	285	285	285	285	285
Steam output, lb per hr	1008	1557	2070	2683	3150
Quality of steam, per cent	99.64	99.71	99.70	99.82	99.77
Fuel burned, lb per hr	73	115	150	192	229
Evaporation, lb of fuel	13.8	13.5	13.8	14.0	13.8
Separator trap discharge:					
lb per hr	305	423	226	88	321
per cent water input	23.2	21.4	9.8	3.2	9.2
Excess air, per cent	115	80	58	35	23
Efficiency, per cent	82.34	80.61	82.64	83.93	82.94

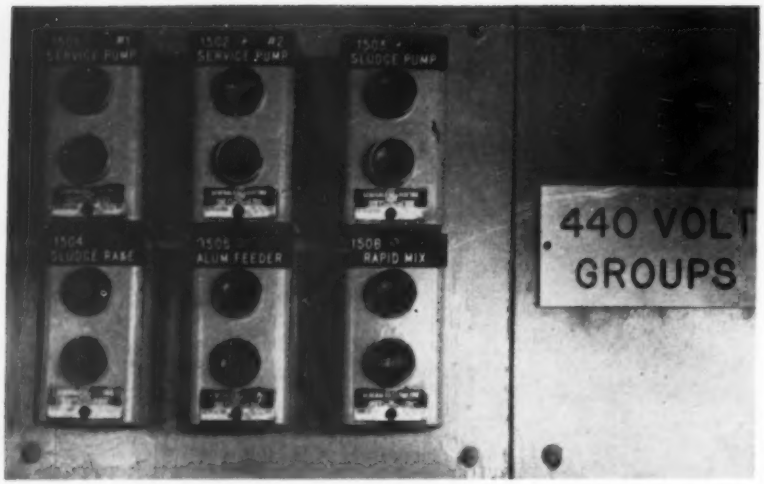


Fig. 1. Labels, showing the different color combinations obtained with laminated plastic construction

Power Plant Labels That Last

Most labels are readable when new, but few of them remain easy to read after years of service. The labels shown here are neat and clear when first installed, and do not deteriorate

PROPER LABELING of switches, push buttons, valves and other controls is important for the operation of all mechanical, electrical, and chemical systems. At best, poor labels cause confusion in time of trouble while the figures on the labels are deciphered; at worst they cause station outages, or even loss of life if a station operator opens the wrong valve or closes the wrong switch through misreading a label.

A good label must be legible; neat, and impervious to dirt, weather, oil, or any process fumes or liquids with which it may come in contact. It should be easy to clean and it must be cheap.

The labels illustrated on this page pass all these tests. They are made of laminated bakelite or similar plastic, with a thin upper layer on a thicker base of different color. The figures are engraved by cutting through the upper layer, leaving the base exposed. The layers may be either black on a white background, or white on black, or any other combination. The plastic is unaffected by weather, fumes, or liquids, and can be cleaned with a damp cloth. They apply to large outdoor notices as well as small indoor tags.

Fig. 1 shows how the color combination of each label may be chosen to make the figures stand out against their backgrounds. Fig. 2 shows an unusual way to label a valve. With this method there can be no mistake which label identifies which valve. Fig. 3 shows how clear these labels are for use in outdoor transformer and switching stations.

Fig. 2. The photo shows an unusual and efficient way of identifying valve

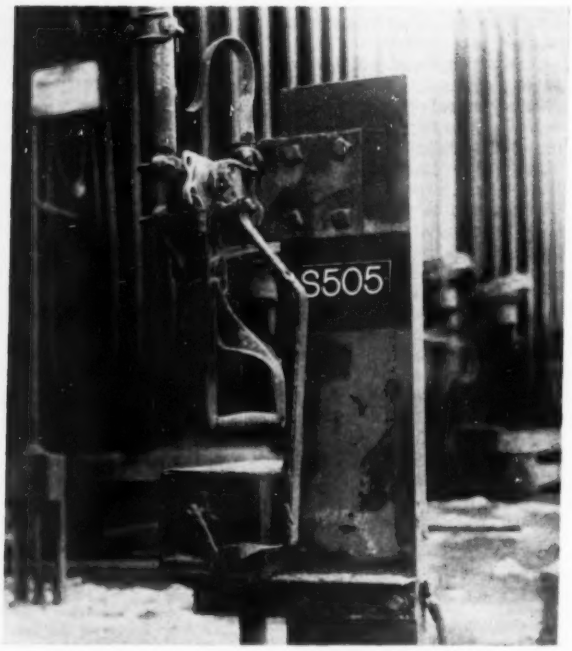


Fig. 3. This clear label prevents a wrong operation of high voltage switch

Power Engineering's

PRACTICAL ENGINEER and ELECTRICIAN SECTION

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Why Steam Traps Are Important

By G. R. SETTERLUND

MORE ENGINEERS have been trapped into a false sense of security by these innocuous-looking *piggy banks*, than by probably any other steam appliance known. They are generally tucked away where no human being ever intends to go. Whenever I think of the word *trap*, and who doesn't when the wind starts blowing cold, I muse over the word itself and letter by letter find that it covers just the things one should think of when considering traps: T-type; R-reliability; A-approved installation; P-preventive maintenance; S-standardization.

T-type — Whether already installed or still on paper, has the proper type been selected? The design is all-important. There are literally volumes of information available from reputable manufacturers that will help you select the proper type for the job. There are bucket types, float types and thermostatic types designed in such numerous styles that they can be almost considered *tailor-made*. When the type has been considered carefully, select the proper size. Again, the use will govern the selection, as regards pressure, design, flow capabilities, size of connections and availability of spare parts. A standard Cardex system can carry this information and be readily available if properly entered for each trap installed.

R-reliability — You had best be guided by past experience in the selection of traps under this item — are these traps rugged? They have a great deal of work to do before they will be removed and scrapped. Can we rely on the manufacturers to give us sure, relatively swift service for spare parts and replacements? If in a corrosive atmosphere, will the body stand up or simply *fade away;* old soldiers have been known to do so and they are not expected to be continuously alert for years on end as our sentinel, the trap.

A-approved installation — Generally speaking, you will find that a repetition of trap services prevails in a plant of any size, and consequently a standard approved installation will greatly facilitate checking and will assure proper installation. Drawing up even rough sketches as shown in Figs. 1 and 2 and making these sketches *official* will soon give the trap system a neat methodical appearance. These sketches or prints will give the operators and maintenance men a good idea of what a trap installation should look like, and if installed properly as shown by the sketches will add to the efficiency of the system. You will note that for easy operation checking there is a check valve and also a test valve at each unit. It should be mentioned here that grading the lines is all-important if you do not wish to encounter a corrosion problem and poor operation. Before selecting a satisfactory installation, the manufacturers' guides should be studied. They've spent huge sums of money on research and engineering, and with minor modifications to suit your needs, their installations are generally good. Whatever you do, select a standard and insist that it be adhered to. Arrange the trap so that it can be removed and still not interfere too seriously with operations. Necessity may force an engineer to throttle a by-pass valve a bit to prevent too great a blow-through after the trap is removed.

P-preventive maintenance — The old axiom, *an ounce of prevention is worth a pound of cure*, is so very true that the time spent working out a simple but yet effective Cardex system is well worth the effort. First of all, a survey has to be made of the plant and every trap given a number. This may be done simply, numerically from No. 1 upwards, or it may be *blocked* Nos. 1 to 50 for a certain section, Nos. 51 to 100 for another section, and the like. Be sure to allow extra numbers for future expansion and installations if you use a block system. After the survey is completed, make out a card for each trap along these lines. The Cardex system is very flexible, so there can be no set rule laid down. On one side of card you can list:

Trap No. Location Name Type Style Connection Sizes

The reverse side of the card can be made out in such a way that a maintenance card will be kept, as follows:

Date Inspected Cleaned Parts Replaced Remarks Initials

All heating system traps should be inspected before cold weather sets in, and should be checked probably on a monthly basis thereafter. Assign a responsible operator or repair man to check the traps according to the schedule. Initialling the card will generally assure a proper inspection.

S-standardization — By standardizing on choice of traps, the minimum amount of spare parts only need to be stocked. Maintenance men will become acquainted with the easiest and quickest way of overhauling them. This does not prohibit the trial of new traps.

Take a walk through your plant this afternoon, and look over the trap system. Ask yourself the following questions:

Type — okay for the process?

Reliability — have they given us much trouble?

Approved Installation — how does it stack up to recommendations?

Preventive Maintenance — have we a maintenance schedule and records of inspection and repairs?

Standardization — are the traps standardized for easy inspection and repairs?

Yes! TRAPS are a big item, and careful consideration should be given towards their selection and care to give your plant trouble-free steam service throughout the year.

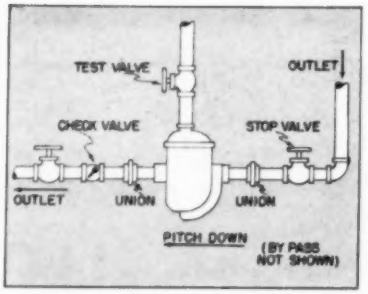


Fig. 2. Another sketch of a steam trap hook-up for use of maintenance men when servicing system

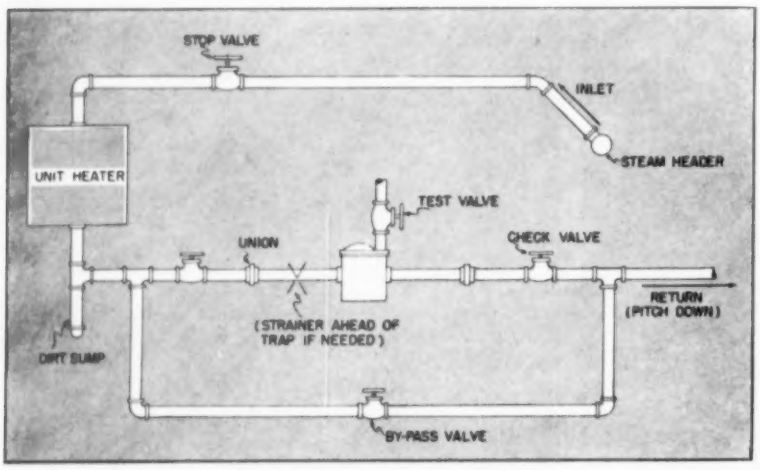


Fig. 1. A sketch of the type which can be made for the use of maintenance men on steam trap hook-up

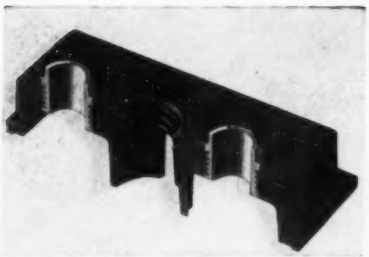


Fig. 1. Industrial battery cover showing how lead inserts are molded integrally with hard rubber. This is the reason why it is necessary to remove cover by the methods described in this article

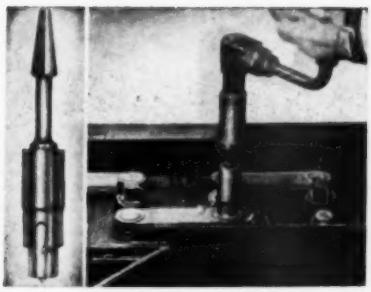


Fig. 2. Drilling annular hole with special tool at left to remove cell connectors and jar covers

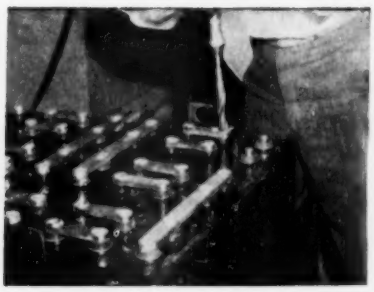


Fig. 3. Method of drilling posts to permit removal of a damaged cover with 15/16-in. drill

Replacing Damaged Battery Covers Extends Useful Life

TO EXTEND the life of an accidentally damaged storage battery, it is often necessary to remove its cover for cell replacement or element repair. Though simple, the procedure is not widely understood, and the following instructions from the Service Department of Gould-National Batteries, Inc. are worth filing in your folder of battery maintenance and repair, and discussing with your shop men.

Because the covers of rubber-jar batteries have post openings which are lined with lead inserts integral with the hard rubber cover (see Fig. 1) and because these lead inserts or linings are welded to the lead battery posts to prevent leaks, it is necessary to drill out gaps between posts and inserts in order to remove a damaged cover.

A special drill has been devised by Gould-National engineers (obtainable as repair tool No. 35459C) which cuts an annular hole (as shown in Fig. 2) and permits the lead posts to remain solid, upright and of normal height after the cell connector and the jar cover have been separated.

The other technique is to drill the posts in the damaged cover to a depth of 3/8 in. using a 15/16-in. drill (as in Fig. 3). This frees the inter-cell connector. Such drilling may then be continued through the cover to free it in turn. This latter technique requires rebuilding the posts before reassembly in a new cover to replace the broken one. Such rebuilding is done by a simple lead "puddling", applying heat by a carbon electrode manipulated within the cavity of a simple post mold. Post molds are available as purchased items if the maintenance man does not care to make his own (maintenance tool No. T-77013).

In the case of certain battery designs there is sufficient clearance between the inter-cell connector and the top of the cover so that the first drilling may be eliminated by a horizontal saw cut under the connector.

In cases where the cover is not damaged, but both cover and elements are to be withdrawn from the jar for basic cell repair, it is only necessary to remove the inter-cell connector and lift both cover and elements as a unit (as shown in Fig. 4). Note the jar hold-down clips to which chains are attached. The chains may be stepped upon by the repair man as the cover and element are lifted. The lifting tool in this case is a post cutter with its edges dulled. During such repair it is not even necessary to remove the inter-cell connector from the post to which it is welded if a mere saw cut through that connector (immediately above the line of junction between the bad cell and its neighbor) is permissible.

Fig. 4. Pulling the cover and element of a battery simultaneously is a technique useful when the cover is not damaged. Note the hold-down clips, kept tight by maintenance man's weight on them

Silica Gel Dryer Problems

By PAUL C. ZIEMKE

THERE IS A GOOD DEAL of controversy afield to the effect the heating up of a drier in service indicates it is doing a good job of moisture removal. The negative side says — whether wet or dry, silica gel and activated alumina heat up when the refrigerants, sulphur dioxide, methyl chloride and Freon-12 come in contact with them. It is then obvious that a hot drier unit is not of necessity an indication the drier is removing moisture. The heat test has no value for silica gel and activated alumina.

Drierite heats up only when moisture comes in contact with it. There is no heat due to absorption of refrigerant, thus the heat test might indicate a good drier, but only if it was possible for the refrigerant to be admitted so slowly that the refrigerating effect is much less than the heat generated from the chemical reaction of moisture in Drierite. Tests show that the refrigerating effect predominates over the chemical heat effect. The heat test will not show a Drierite filled drier unit good or bad since it will not heat up in either case.

On one particular job I used three silica gel driers yet still did not achieve complete absorption of entrained moisture. However, the use of one Drierite completely cleared up the situation. Caution: store your Drierite in an atmosphere of approximately 60 F to ensure against loss in efficiency.

Watch Those Belt Tensions

BY PAUL C. ZIEMKE

ON A COMPRESSOR call, the owner asked if I could advise on his pump problem. I could, and did. The recurring fuse failures were directly chargeable to the overly tight belts. With careful tensioning, where the belts squeaked and slipped just a little on starting the trouble was over for good. At the pleased owner's suggestion others with similar problems had their belt drives retensioned to produce the smooth running units they hoped they had purchased originally.

The same caution applies to the air-conditioning installations where just a little extra time will be expanded into extra dollars in goodwill through the years ahead.

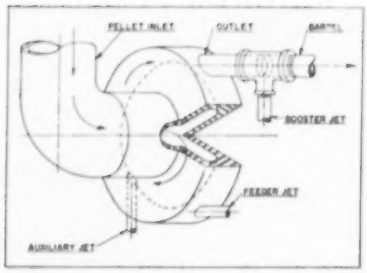


Fig. 1. After considerable development work, this final design of pellet gun emerged. Operation of fireside slag removal gun explained in text

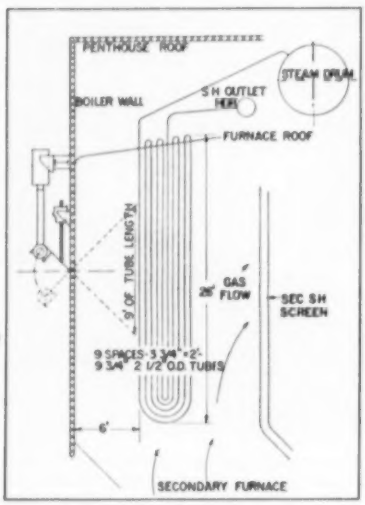


Fig. 2. At Ridgeland Station, six pellet guns are arranged in tandem to clean pendent superheater tubes in Boiler No. 1; guns mounted on outside of the boiler wall; dotted lines show the area covered

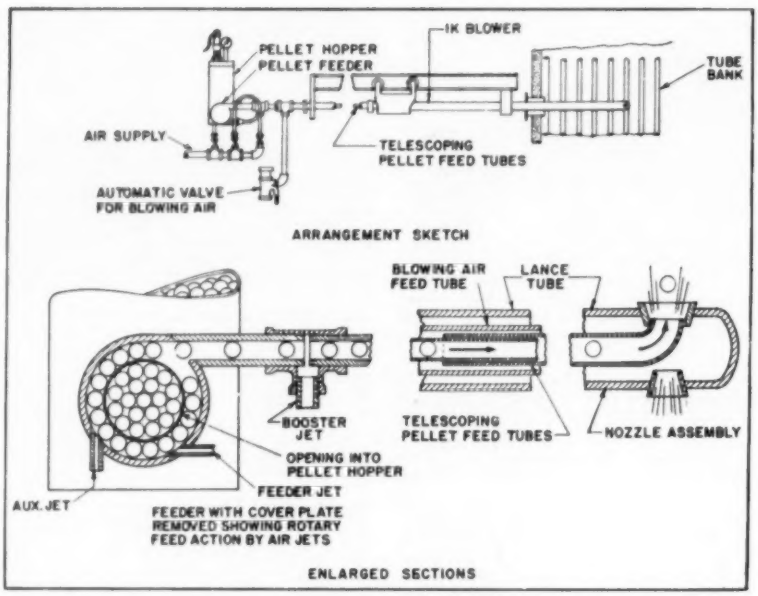


Fig. 3. Depicting details of pellet gun as applied to standard long retracting type deslagging blower

Shoot That Slag!

New pellet gun is effective in removing slag deposits in hard to reach areas in boilers and furnaces, without damage to heating surfaces. It does this at distances up to 35 ft; has also been fitted to long retractable blowers

SPECIALLY-DESIGNED pellet gun for removing slag deposits in very high-duty furnaces, and in furnaces using particularly low quality fuel, has been developed recently by engineers of the Diamond Power Specialty Corp. Months of tests, in which use of .22 caliber rifle bullets, various gage shotguns (previously used off and on for more than 50 years to remove slag) and even small-caliber machine guns was rejected, preceded final design.

High cost of explosive cartridges finally dictated the selection of compressed air as a projecting medium. Small steel shot of B-B caliber were first selected as pellets. During development, care was taken to perfect a feeder with no moving parts, low power requirements, uniformity of feed rate and portability.

Feeder Mechanism

First model gun resulting from this investigation, using $^{9}/_{16}$-in. diam glass marbles, was operated successfully to remove slag from local areas on operating boilers. It proved in principle that pellets could be used for this purpose. Final design of the pellet feeder mechanism is shown in cut-away perspective Fig. 1.

Pellets are fed into the center of a hollow disk by gravity. A feeder air jet enters the disk at the bottom and tangentially, and produces circulation of pellets in the feeder. The outlet, 180 deg from the jet inlet, removes pellets one at a time and discharges them into the barrel. Tolerance within the disk aligns the pellets in single file.

The feed rate has been successfully varied from 50 to 250 pellets per sec. Use of compressed air is comparatively economical. Source pressures of 80 to 250 psi have been successfully used, giving air consumption rates varying from 100 to 340 cfm free air per feeder.

A booster jet further downstream admits compressed air at a pressure higher than that in the feeder. This pressure governs the force with which the pellets are discharged. Striking power of the pellets varies with barrel length, mass of the pellet, booster air pressure and diametrical clearance between the pellet and the barrel. Velocities as high as 1400 fps have been recorded. A gun with a 24-in. barrel and 70 psi tank pressure in one test shot pellets at a velocity of 571 fps. Feed rate and velocity of pellets are completely divorced in this model.

Six such guns, arranged in tandem to the same pellet supply tank, have been installed on No. 1 Boiler at Commonwealth Edison Co.'s Ridgeland Station in Chicago, as shown in Fig. 2. These guns were arranged to clean each side of three pendent radiant superheaters installed for test purposes in the boiler. Platens were kept entirely clean of slag wherever the guns could be aimed; because platens did not register with front wall openings, only three of the six guns could be effectively brought to bear on the desired area.

Pellet Blowers

Modifications of this installation and other applications are being made. After the feeder had been developed and while a multiple gun was being designed, an application of the pellet gun was made to the otherwise standard long retracting type deslagging blower as shown in Fig. 3. No effort is made to accelerate pellets through the feed tube. Instead, normal blowing medium provides required acceleration to pellet

when it leaves the muzzle. A trial installation proved feasible and since then 22 deslaggers have been fitted with pellet feeders in Chicago.

Twice a week, pellets are fed through the deslagger, in addition to the regular blowing medium, to remove any unusual slag deposits which have accumulated. Tests in the early spring of 1952 indicated at least a 10-ft vertical cleaning radius was possible on some installations, with a feed rate of approximately 75 pellets per sec.

Further study is also being carried out to determine a suitable and economical material for all types of pellet guns. Glass marbles, wooden beads, plastic beads, screened gravel, cherry pits, compressed salt, asphalt and asbestos mixtures, hollow gelatin golf ball centers and even dried peas have been considered. To date, ½-in.-diameter asphalt-asbestos pellet is considered the best.

The above facts were explained in more detail by W. F. Cantieri, chief engineer of Diamond Power Specialty Corp., in a paper before the 1952 Annual ASME Meeting.

An Old and Costly Danger: Water Carry-Over

WATER CARRY-OVER is just as simple as it sounds. It is the entrainment of water particles by steam flow through the boiler to the turbine. Water can cause severe damage to the turbine. Blading may be damaged so that severe rotor vibration results; or, sudden cooling effect of the water might cause rubbing of wheels and casing.

Definite case of carry-over occurred at one of Detroit Edison Co.'s plants several years ago, according to a recently-published issue of *Coal to Kilowatts*. Water carry-over damage made it necessary to replace a main thrust bearing, high-pressure impeller and reblade several stage wheels. The whole rotor had to be replaced so that necessary repair work would not keep the machine out of service for too long a time. The illustration shows damage done to the first four stage wheels.

Carry-over can result from two main causes: (1) priming; and (2) foaming. Priming is production of wet steam or possibly slugs of water caused by operating conditions. Foaming refers to a condition where a stable foam is produced on boiler water surface, and is a condition of the water or chemical treatment given to it.

Causes of Priming

Priming may be produced by too high a water level, large variation in load, rapid fluctuation in pressure or overtaxing steam storage capacity of boilers.

Any of these conditions might start priming at any pressure or temperature. The amount of priming necessary to get carry-over at the throttle depends upon firing rate, heat transfer surface, steam disengagement surface, tube cleanliness, gas flow rate and temperature. Other factors are feedwater temperature, furnace baffling, damper settings, and piping arrangement from boiler to turbine.

Carry-over would be more likely to occur with a sudden drop in pressure if the boiler were steaming at a high rate rather than a low rate, and with a high water level rather than a low water level. Various combinations of conditions are possible, with so many factors that might change. In a case where trouble occurs, carry-over might be due to a combination of priming and foaming. This combination is a result of a sudden change in concentration of soluble salts in the saturated steam drum. Wet or saturated steam may be produced at the throttle because of emergency conditions which would lower temperature and still not cause priming or foaming. Saturated steam at the throttle would be possible at operating pressure. The faster the temperature dropped the higher pressure would be when the saturation point was reached. This pressure could be anywhere between operating pressure and atmospheric pressure.

Rapid Pressure Drop

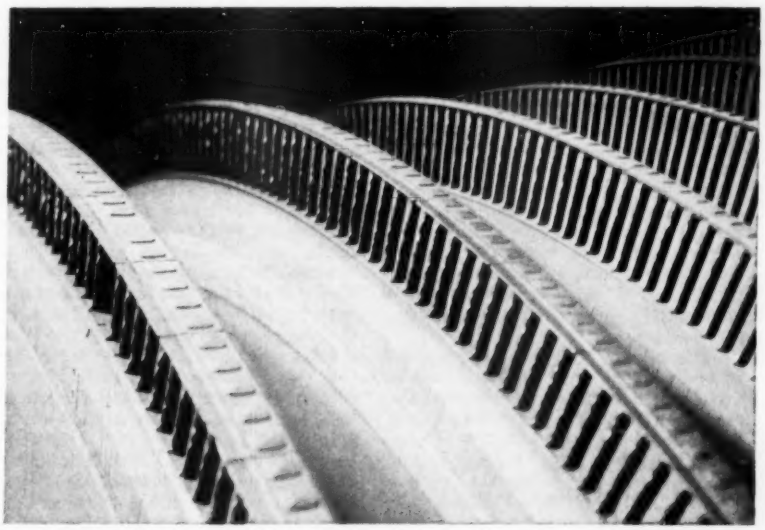
In a case of a sudden load pickup, pressure drops because boiler demand exceeds the supply available at that instant. With sudden pressure decrease and boiler water "swell," carry-over would be possible — even though throttle steam was still superheated. This carry-over, itself, would further reduce temperature so that serious damage to the turbine might occur, either from too rapid cooling, or slugs of water hitting the blades.

Another factor of concern is the load carrying capacity of the turbine with a decrease in pressure. If throttle conditions are lowered, less work (machine output) is obtained from the steam so that steam demand is greater for the same load.

Throttle-pressure regulators have been installed on many Detroit Edison turbines. These regulators respond to a decrease in throttle pressure to close the admission or throttle valve. Pressure at which these regulators are actuated depends, of course, on operating pressure and machine design.

In the low-pressure section of one plant, regulators are set to start operating at about 50 psi below normal throttle pressure. This protects d-c load in the event of a trip-out during a low-load period.

The rest of the pressure regulators are set to operate between 100 and 200 psi below normal throttle pressure. These pressures are determined by calculations and tests. A balance point must be established so that a pressure drop will not cause an excessive load drop at the same throttle flow, or that the maximum allowable moisture content is not exceeded in later turbine stages.



Carry-over did this to leading edges of the turbine buckets—a typical danger of foaming and priming

It must be remembered that subnormal pressures are not intended to serve as an operating point, but only to serve as a stop-gap measure so that load will be reduced until pressure can be restored to normal, the load reduced further, or the machine taken off the line properly.

Regulator in Action

A recent occurrence in which the throttle regulator played an important part involved a new machine. Throttle pressure had dropped and the turbine was automatically unloaded before saturated steam could do any damage. Conditions were corrected and the machine put back in service.

These unloading devices are superior to the previous method of blocking the governor. If boiler capacity is sufficient to handle a load increase and the governor is blocked too low, the load increase would run the governor against the stop making it necessary to lower the load to unblock the governor. This would all take time and impose a handicap on the rest of the plants and the system.

Carry-over is a potential danger source at all times, and, as explained, can occur at any pressure and temperature, depending upon operating conditions. With the advent of automatic load frequency control, regulating devices are being incorporated through DE system so that normal load swings can be handled as routine matters. Radical changes due to local emergencies must be handled as the situation demands.

Gage Glass Erosion

OCCASIONALLY, reports outline difficulties experienced in both round and flat type gage glasses. Most frequently the problem is cited as one of erosion or attack on the gage glass itself, resulting in clouding and occasionally in leakage or breakage, according to the *Betz Indicator*.

It is frequently thought such troubles are due to the character of water treatment employed. Following are results of an investigation of this problem.

Severe wear normally takes place at the bottom of round gage glasses and is usually attributed to erosion of the glass due to high velocities when the gage column is blown. It is true that some softening attack on the glass at this point may take place due to intermittent contact with alkaline boiler water, but most manufacturers agree high velocity is the cause for actual glass losses.

Flat type gage glasses normally have grooves and ridges on the water side to produce a definite optical effect at water level. When new, the ridges are smooth and round. Gage glasses have been received where the ridges had almost completely disappeared below the water line, while still remaining smooth. Other gage glasses received showed severe attack on glass above the water line; namely, in the steam condensing section. Attack above the water line left ragged, sharp edges. This is the more common type of attack.

Manufacturers of Pyrex glass and also of gage columns could offer no information as to the cause of these conditions. Theories mentioned so far have been gradual solution of glass below the water line by alkaline boiler water. Above the water line, it was claimed that some gas or chemical redissolving in the condensed steam causes the attack. Actual gases were not mentioned.

In one plant, flat gage glasses had to be replaced at intervals of one to two months because of leakage at the gasket. Attack was all above normal water level. Several samples of condensed steam were obtained and analyses run for ammonia, carbon dioxide and fluoride. Fluoride was zero, and ammonia and carbon dioxide was in a relatively low range.

Specific recommendations by gage column manufacturers to prevent this attack on flat gage glasses include insertion of a mica shield between gage glass and water. Mica shield will protect the glass and not interfere with its optical characteristics. Replacement of the shields is necessary at very infrequent intervals and is dependent on the number of times the mica is cooled and heated again. Reports indicate a new shield will be required after removing the boiler from the line and placing it back in service approximately 15 times.

Where continuous difficulty is experienced with round gage glasses, the manufacturer suggests changing to the flat type with the mica shield.

It will be readily seen that the problem involving loss of gage glasses is not one due to chemicals that may be added to the boiler for water conditioning.

Suggestions About Suggestions

By WILLIAM SHEFFER

IT WOULD NOT amaze this writer to discover that the average "suggestion box" or "Merit Award" system is only slightly efficient, when compared with the total need for such systems. When we consider that a suggestion is an implied criticism, it is readily apparent that many persons simply would not "suggest", and also that, in cases where the suggestions are placed before a board of judges who were initially responsible for the need of such suggestions, the idea put forth by the ambitious employee would have but short shrift.

Such diversions of progressive ideas often take the form of a bland ignoring of the exact point made in the suggestion. Or, perhaps, the idea is set aside on the grounds that it is too complicated. The latter is, of course, an easy exit from a change of operations. Or the suggestion is side-tracked because it "has been thought of before" — overlooking, of course, the fact that what was once not feasible could obviously be most applicable at the present time.

Suggestions take, roughly, two forms. One: — ideas offering sheer gadgetry, safety measures, minor mechanical changes, changes in format of paper forms, and so on. Two: — suggestions having to do with major operating policy.

These latter are of great importance, emanating as they do from those very close to the source of the need, and from those not blinded by any considerations but those engendered from the job. These suggestions are the least likely to be accepted. It would be interesting to examine the type of suggestions received by the various systems in operation, and learn what percentage of gadgetry items are promoted, as compared to those ideas offering policy changes.

It might be wise at this stage to note that while minor savings can be made in any organization by catching up on relatively small items, the major cause of inefficiency and gross loss is in the errors involved in the operation of the general policy of the organization, and, basically, in the conception of that policy. In organizations where reward notices are published, few suggestions reach out of the gadgetry category.

Looking over the power engineering field for the past few decades it seems that the intellectual level of the average employee has risen tremendously. High school graduates are a dime a dozen, BS's and AB's only slightly less plentiful. Thus, with physical labor reduced almost to a minimum, and the educational level raised, it would seem that many valuable suggestions on the higher plane should be available. Where are they? Have they been offered and ignored?

In an organization where promotions and appointments are made on a basis of sheer ability, suggestions would be accepted readily, for naturally they would be placed before a higher type of person. Oddly enough, in such an organization, it is likely that the need for suggestions would not be too great. A concern in which nepotism, office politics and sheer indifference reigned, while greatly in need of suggestions, would show a low demand for them.

The whole problem is interesting, and involves a wide field in human relations to anyone interested, and at all levels.

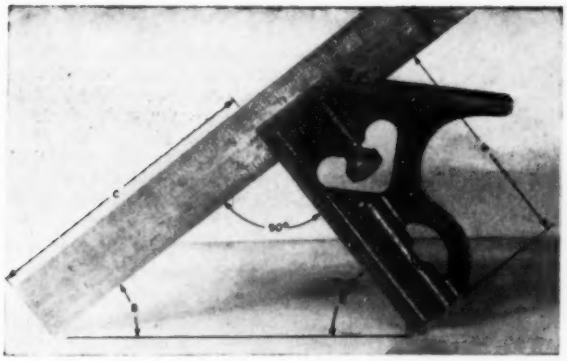


Fig. 1. Above — Machinist's square measures angle of work and surface plate

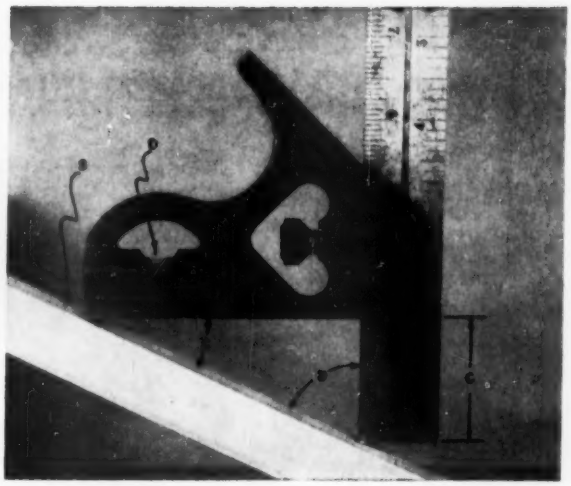


Fig. 2. Square used to measure the inclination of work surface to horizontal

Measure Your Angles with a Square

By F. E. RILEY

AN ORDINARY machinist's square with an adjustable calibrated blade can be used to measure angles on the surface plate very accurately.

The method is useful when a protractor is not available and in some circumstances it is more accurate than a protractor.

Figure 1 illustrates the technique. The square is put on the surface plate as shown, together with the work, whose sloping face is placed in contact with the face of the stock or with either the inside or outside edge of the blade. It will be apparent that angles B and C can be increased or decreased by sliding the blade in the stock. The blade can be set at any required angle by making C the proper length, which length is found by using trigonometric tables and a standard formula for right angled triangles.

Conversely, by setting the square so that the blade or the face of the stock makes contact with the angular surface of the work, the angle of this surface can be found by reading length c and using this length to calculate angle B. Since the length b of the square stock is fixed, the only variable is the projection of the blade from the stock, or side c. The formulas required for angular measurements with the square are:

1. Tan B $= \frac{b}{c}$

2. Angle C = 90 deg − Angle B

Here is an example to show how simple the method is. Suppose we want to set the square so that angle B is 30 deg, and suppose the stock is 3.5 in. long. From the trig tables, tan 30 deg is 0.57735, which we substitute in the formula tan B $= \frac{b}{c}$, giving $0.57735 = \frac{3.5}{c}$. Transposing, $c = \frac{3.5}{0.57735}$, which gives 6.062 in. when worked out by long-division. This is the length of blade which has to project from the stock to give an angle B of 30 deg.

At this angle, a 1/64th in. error in length c will produce an error in angle B of 4 minutes of a degree. As c becomes shorter, the same error in its length will naturally cause a greater error in angle B, but the square will still be more accurate than a normal shop protractor graduated in whole degrees.

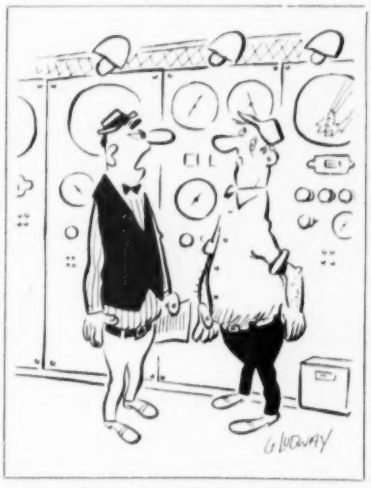
The accuracy of the method depends a lot on the sharpness of the blade corner at the apex of angle B and the corner of the stock at the apex of angle C. If these corners are worn and rounded, the square will not be accurate for angular measurements, and before using it for this purpose the corners should be ground sharp.

Since B, the length of the stock is used in every calculation, and since it is a fixed length, the figuring will be simpler if b can be made a whole number, or as close as possible to a whole number. For example, if it measures 3.505 in. by micrometer, the odd 0.005 in. should be ground off to make it 3.5 in. exactly, which is a much easier figure to use in calculations.

Another way to use the square as a protractor or inclinometer is illustrated in Fig. 2. This technique uses the spirit level which is built into most good quality squares. The method is useful when erecting large machines or structures on a floor plate which is known to be dead level, and where part of the structure has to be set at an angle to the base.

Suppose we want to find the angle surface S in Fig. 2 makes with the horizontal. The square is placed on the sloping surface as shown, and the blade adjusted until the bubble D is in its dead level position. Then distance C is measured and angle C calculated as above.

This method is not as accurate as the one where the square is used on the surface plate, because a spirit level mounted in a short based holder is not very accurate, for the stock has to be tilted a lot to produce a small movement of the bubble. However, the method is accurate enough for quite a wide range of work.



"When you're operating the board, Swingt, I've noticed all the men are wide awake and on their toes."

FOR THE POWER PLANT ELECTRICIAN

Conversation About a Wrong-Way Wattmeter

By FRANK J. SCHNEAUBELT

WHILE CONVERTING a power plant from 220-v d-c engine-driven dynamos to 440-v a-c turbine generators, the indicating and recording wattmeter registered in reverse on the second machine installed. The boss-engineer from the office suggested: Let's reverse two leads on the current winding — just like reversing a 3-phase motor. Engineer Frank, assigned to the job, replied: That may be all right and it might make things worse. I'm going to ring-out the leads and see if they are correct or not first.

Boss: But we're in a hurry to get the machine on the line.

Frank: So am I, but I'd rather be sure than sorry. I'll ring-out only the three current leads for a start, and that won't take long.

Boss: But why not try reversing the leads first? — it's simple and doesn't take much time.

Frank: Because while it may reverse the wattmeters, it may make things worse; and the wattmeters may not indicate correctly. Why guess?

The electricians ring-out the current leads. Lead 1 is on phase 1, lead 2 on phase 2, and lead 3 on phase 3. Now, everyone is puzzled, and Frank remarks: It is rather obvious that switching two leads would have made things worse.

Boss: Yes, of course, but what now?

Frank: Get the electrician who wired the instruments.

(He is found and brought up.)

Frank: You remember the current transformers at the generators? — three leads are brought up individually and the other side has a common lead, three leads tied together.

Electrician: Yes.

Frank: Where is the common — on top or on the bottom?

Electrician: On top.

Frank: What does the drawing show?

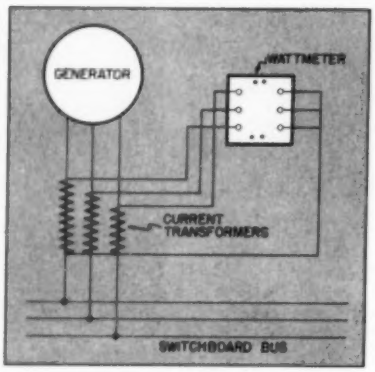
Electrician: On top.

Frank: Good, so far. Now, look at it this way — is the common toward the generator or the switchboard side?

Electrician: I don't know. The drawing showed the common on top, so I put it on top.

Frank: Let's get the drawing.

The drawing is brought up and checked. While the common lead is on top, it is on the generator side instead of on the switchboard side, as shown.



This sketch shows leads in their correct position. Leads on the wrong side of the current transformers caused the wattmeters to indicate in reverse

Common lead is transferred to the bottom of the current transformers and the three individual leads transferred to the top. This reverses the current in the coils of the wattmeters, and the instruments indicate correctly.

Moral: Don't guess at electrical work. Don't just switch two leads and see what happens — it might happen.

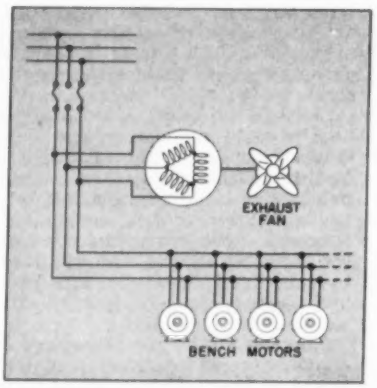
Can Three-Phase Motors Start Single Phase?

By FRANK J. SCHNEAUBELT

MAINTENANCE ELECTRICIAN BILL calls engineer Frank one day, and asks: How can three-phase motors start with one main-line fuse out?

Frank: They don't.

Bill: I have some that do — a whole bench-full of 'em. Wanta come down and see 'em?



Sketch of the circuit with exhaust fan, bench motors and one main-line fuse out, as drawn by Frank

Frank: That I want to see. I'll be right down.

Frank meets Bill in the shop, and right away Bill climbs a stepladder and pulls a main fuse on one of the circuits serving a number of bench motors. Bill then goes to the bench and switches off a motor, waits until it stops, and then turns the switch on again. The motor starts right off. Bill goes to another motor, and another, and so on down the bench. They all start.

Bill: See!

Frank: Yes, I see.

Bill: I was taught that three-phase motors cannot start single phase.

Frank: You were taught correctly.

Bill: Well?

Frank: Well, what?

Bill: Well, what's the answer?

Frank: Look around.

Bill: I've done that plenty, and I'm stumped.

Frank: Saw nothing?

Bill: Saw nothing.

Frank: See that big exhaust fan on the ceiling? Shut it down.

(And it is shut down.)

Frank: Now try your motors.

(Bill does, and they no longer start.)

Frank: See?

Bill: Yes, I see that the exhaust fan on the same circuit is the answer; but, running single phase itself, how does it furnish three-phase current to the bench motors? It is a motor not a generator.

Frank: Every motor is a generator, even the squirrel-cage induction motor. When you switch on a motor, how much starting current does it take?

Bill: It takes from 2½ to 3 times full load current.

Frank: And why does the current drop off as the motor speeds up?

Bill: The motor generates a counter electromotive force which bucks the line voltage and thus reduces the applied voltage. So the current must drop. But I still do not see how this applies to the idea of furnishing three-phase current to the bench motors.

Frank now draws a sketch of a circuit with bench motors, a large fan motor, and one main-line fuse out. He explains that the exhaust-fan motor, although running single phase and carrying its own load on one of its three windings, nevertheless generates a three-phase CEMF, and that this is connected to the bench motors. The rotating armature, excited from the one winding in use, sweeps past the other two windings and so generates the CEMF in them as well as in the winding in use.

Note that while a main-line fuse is out, the circuit is complete (all three lines) between the fan motor and the bench motors. In addition to the main-line fuse to protect the circuit, there are also fuse boxes for each motor.

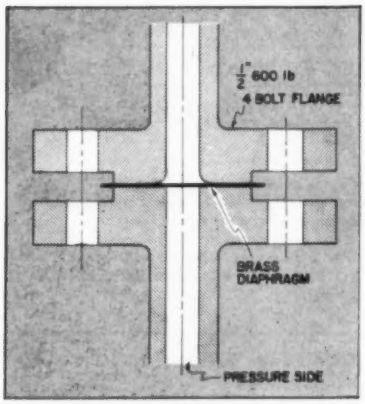
Bill: Thanks, Frank, but I'm afraid I'll have to take your sketch along and study it a bit — sounds logical, but it's still a bit hazy and strange.

PRACTICAL HINTS AND KINKS

Diaphragms Replace Safety Valves, Prevent Clogged Chemical Lines

By D. H. MARSHALL

A POWER PLANT had trouble with the safety valves on their pumped chemical lines to the boilers. By the time they repaired and replaced the valves, the chemicals had solidified in the lines and the boilers had to be



It is far quicker to replace this diaphragm than to repair a safety valve; saves cleaning boiler lines

out of service until the lines were cleared. So they replaced the safety valves with homemade brass diaphragms, which did the same job as the valves but could be renewed in a few minutes.

Their machine shop made a set of flanges with raised faces as shown in the sketch. The inside edge of the face in the direction of flow was rounded to make sure the diaphragm would rupture and not shear. They calculated the thickness of diaphragm needed, then proved them on a dead weight tester. A 0.004 in. thick brass diaphragm failed at 650 psi, a 0.005 in. diaphragm at 850 psi.

Now, if a diaphragm breaks, the operator just shuts off the pump, opens the flange, puts in a new diaphragm, and starts up again long before the chemicals in the line have had time to solidify.

Drilling Glass With the Electric Hole-Shooter

By PAUL C. ZIEMKE

DRILLING GLASS has always been a tedious operation when performed by hand, and with the power tools many a fine job has been ruined because of either excessive speed or pressure.

For holes of medium and larger sizes in glass, use brass or copper tubing, and outside diameter equal to or microscopically larger than the hole required. Revolve the tube at a peripheral speed of about 100 fpm and use carborundum (80 to 100 grit) and light machine oil between the end of the tube and the glass. Insert the abrasive under the tube with a thin wafer of wood or feather to avoid scratching the glass. The glass must be supported by sponge rubber or heavy felt not much larger than the hole to be drilled. Now, take pains and drill hole half way through, then turn the work over and complete. Any slight lack of concentricity between halves can be reamed by use of the tube and turpentine, plus the grit, or use a round file with turps only.

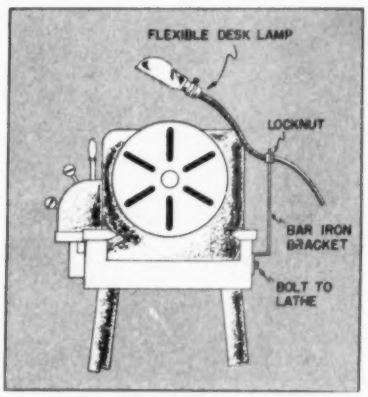
For comparatively small holes, a solid drill is recommended, or use a three cornered file, grinding the end to a long triangular shaped point. Use a power drill running at 1800 rpm or over. A mixture of turps and camphor should be used as lubricant. Holes up to ½ in. in diameter can be drilled in glass with a flat drill which has been hardened in sulphurous acid, a mixture of turps and camphor being used as a lubricant.

Precaution: For extreme care and accuracy when drilling glass, you must clamp a block of wood over the work and drill through it with the glass.

Flexible Lamp for Lathe

By THOMAS TRAIL

A SIMPLE FLEXIBLE lamp to illuminate any part of the work in a lathe may be constructed from a discarded desk lamp and some scrap metal, as shown. Where desired, the lamp may be connected to the lathe power circuit to use with a 220-v lamp bulb. Such an arrangement may also be used on power pipe threading machines, etc.

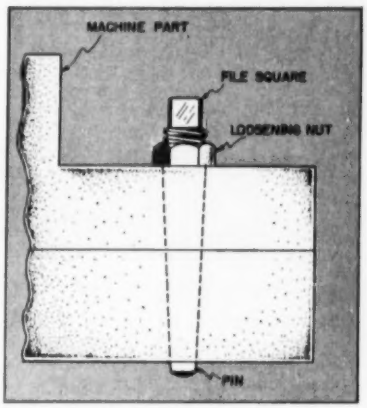


Desk lamp and scrap metal make lathe light

Using Tapered Line Up Pins

By JOHN FOSTER

WHEN INSTALLING a tapered line up pin, with a nut threaded on the top for loosening, it is well to provide an additional ¼ in. of pin length projecting and filed square, as shown.



Part of line up pin filed square eases pin removal

This will furnish a means of holding the pin with a wrench when turning the loosening nut, in case the small end of the pin has become burred.

Everything in Its Place

By CARL THOMAS

Sign calls attention to the missing fire extinguisher

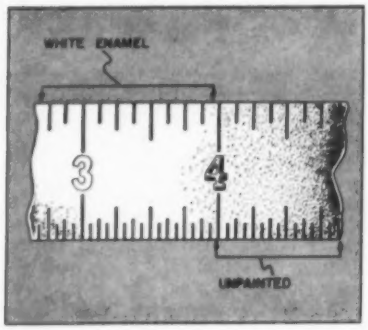
BY LETTERING the wall behind fire extinguishers, as shown, absence of an extinguisher from its proper location will become conspicuous, helping to assure its prompt return.

Make Scales More Readable

By THOMAS TRAIL

FINE GRADUATIONS on steel scales, micrometers, vernier instruments, etc. can be seen more readily if the

metal surface is first cleaned thoroughly with a grease solvent such as mineral spirits and dried, and then given a coat of white enamel and allowed to set for a few minutes. When wiped clean with a lint-free clean



White enamel in depressions improves visibility

cloth, the enamel will be left only in the graduations and figure depressions, as shown. White finish, of course, reflects light more readily.

Avoiding the Bug-a-boo of Voltage Drop on Power Tools

By PAUL C. ZIEMKE

CALLED IN on an occasion to determine why a power drill did not cut, the very obvious reason was found in the 500 ft of No. 16 gage power cord infested with a host of badly weathered connections. The table indicated can also be used for calculating the extensions to outbuildings and barns, or the boathouse at the lake. Ohms law knows no favorites.

This table applies to 110 volt a-c tools or installations. For 220 volt service use wire size corresponding to an extension length of one-half the contemplated length. Also consider using a booster transformer.

Full load amp rating for tool	0–2.00	2.10–3.40	3.5–5.00	5.10–7.00	7.10–12.00	12.10–16.00
Length—one way		WIRE SIZE B&S GAGE				
25 ft	18	18	18	18	16	14
50 ft	18	18	18	16	14	12
75 ft	18	18	16	14	12	10
100 ft	18	16	14	12	10	8
200 ft	16	14	12	10	8	6
300 ft	14	12	10	8	6	4
400 ft	12	10	8	6	4	4
500 ft	12	10	8	6	4	2
600 ft	10	8	6	4	2	2
800 ft	10	8	6	4	2	1
1000 ft	8	6	4	2	1	0

NOTE: Read the voltage at the source with a dependable voltmeter. If potential averages as much 10 volts below a norm of 110 v consult your power company, or install a dry type booster transformer to make sure your fluorescent lamps will "hit" at all times and your radio and TV amplifiers produce at optimum values at all times. Low voltage now is so readily corrected there is really no acceptable alibi for enduring it year after year with an increasing aggravation of poor electrical performance.

Mobile Boiler for Quick Use

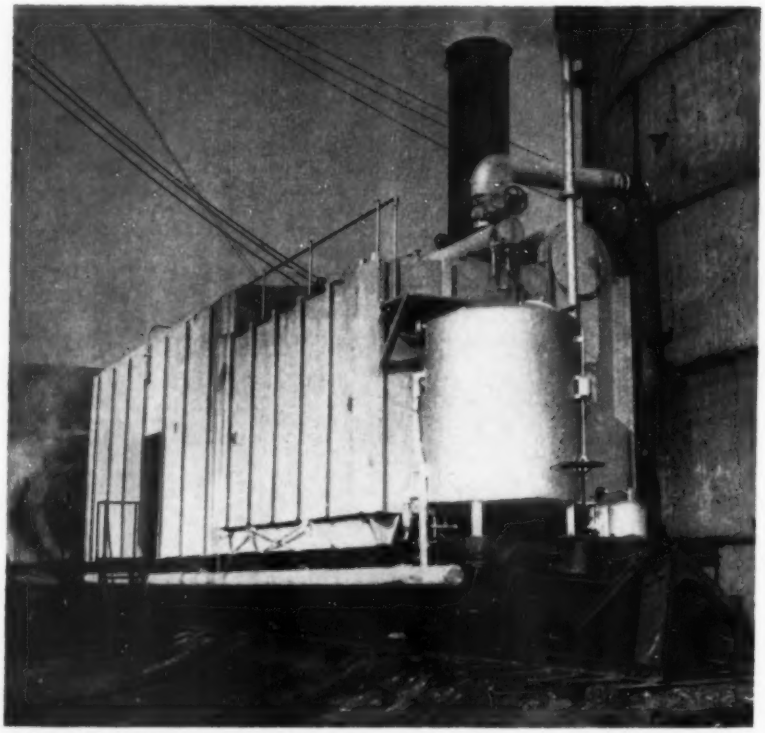
A BOILER HOUSE on wheels, designed and built by engineers of Publicker Industries, Inc., is used for quick movement from plant to plant to supply additional steam where needed.

Capable of producing 20,000 lb of steam per hr, the unit travels on a standard-sized railroad flat car. Pennsylvania Railroad engineers helped with cab design so the car would meet specifications of the American Association of Railroads to move over main lines.

The boiler is a Babcock & Wilcox model for 250 psi maximum pressure. The car also contains a feedwater heater, pumps, starting gas, water treating unit and outside clips for service connections.

The mobile plant is 50 ft long and topped with a standard galvanized railroad car roof. Outside finish is 3/8-in. Insul-Mastic covered with aluminum Gilsonite.

At present the unit is being used to clean tanks, operate steam pumps and supply heat. Only outside electrical, water, oil and drain connections have to be changed when the plant is moved. One engineer operates it.



This is Publicker Industries' new boiler plant on wheels — a 20,000 lb per hr steam generator specially housed on a railroad flat car. At right is the propane gas cylinder used for lighting the starting tank

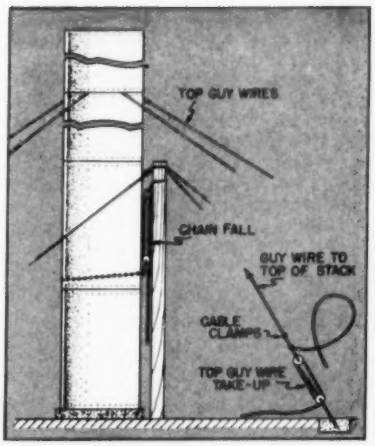
Dismantling Metal Stacks — Top Section Last

By H. NYE JOSLEYN

DISMANTLING a tall metal stack — top section last — is not as difficult as it might sound. Such a procedure becomes necessary when speed is essential and surrounding obstacles make other methods impracticable.

To start, raise a gin pole as close as practical to the base of the stack. A telegraph pole with an 8-in. top diameter and long enough to reach the bottom of the stack's third section, usually 30 to 40 ft, is sufficient. Brace the pole securely with strong cable guy wires, and fasten chain falls near the top. Select a chain fall with enough travel to take down one section of the stack.

Fasten the lower block of the falls to a sling chain fastened around the stack close to the bottom of the second section. Tighten the falls and loosen the stack from its cement foundation. Now for the next step.



Drawing shows arrangement of gin pole, chain falls, guy wires and sling for razing metal stack

Loosen all except the top guy wires. Then install suitable falls, chain or rope, at the supporting base as a part of the top wires. These falls will allow slack in the wires to be taken up as top of the stack lowers.

Continue tightening the chain falls at the base of the stack until the stack is just free from the foundation. Cut off the lower section with an acetylene torch. Remove the severed section and lower the rest of the stack to the foundation, while at the same time taking up on the falls at the base of the top guy wires.

Refasten the sling to the next section of the stack, and then repeat the operation until the stack is demolished. The top section will be the last removed.

In removing the sections, cutting them vertically on opposite sides may speed the job. Where space is at a premium the cut pieces can be pushed out of the way into the center of the stack.

Industrial Static Electricity

FIRES AND EXPLOSIONS originating from electrostatic sparks which annually extract large and increasing tolls from industry, can be controlled to their "virtual elimination," according to Robin Beach, head of Robin Beach Engineers Associated, New York, before the annual meeting of ASME.

Fires and explosions throughout industry which originate from electrostatic cause, outnumber by a wide margin those that result from any other single source. Another costly toll on industry, in addition to that from fire and explosion disasters, is the loss during processing operations.

Costs Insignificantly Small

Costs of a comprehensive survey of the various electrostatic problems in any industry and of the application of effective antistatic controls have proved "insignificantly small" in comparison with the annual savings realized from the investment.

Mr. Beach outlined a program for controlling the subtle sabotage and destructive behavior of static electricity, starting with a thorough quantitative investigation of each hazardous operation. He emphasized the need for specialists qualified in the technology of industrial electrostatics by virtue of specialized training, broad field experience and research facilities.

By installing correctly-applied antistatic controls of either the "ready-made" or the "tailor-made" varieties to electrostatic hazards and kindred problems, many industrial processes can be materially accelerated, production increased, costly spoilage reduced, unpleasant and sometimes harmful humidification systems abandoned, production costs decimated, operating expenditures substantially curtailed and personnel injuries and deaths practically eliminated.

Questions and Answers

Your fellow engineers will answer your power engineering questions. You answer theirs, get paid well. Simple? Effective? Why don't you try it?

Answer No. 504

What Changes Are Needed to Drop Heating Steam from 125 psi to 15 psi?

Evaporation Rate Important

IT IS UNFORTUNATE that L. W. was unable to supply more complete information on actual operation of his boilers. The evaporation rate expressed in per cent of boiler rating would be most helpful.

He does not indicate whether steam is used for any purpose other than heating. It is, therefore, assumed steam is supplied only for heating and that those requirements will remain the same. On this basis it appears that in order to drop pressure from 125 psi to 15 psi, it will be necessary for L. W. to equip his 150-hp, Type XL, Titusville return-tubular boilers with larger safety valves to take care of increased volume of steam at the lower pressure.

This or any other application must have a safety valve with sufficient relieving capacity to prevent excessive pressure build-up when the boilers are operating at maximum evaporating capacity. These conditions naturally depend upon type of fuel, grate area (if grates are used), type and size of burner (if oil or gas is used), draft and type and volume of combustion chamber. As a close approximation one would expect the new operating conditions to require a 5- or 6-in. safety valve on each boiler depending on construction and relieving capacity of the valves selected. Two or more small safety valves giving the total relieving capacity required are often used in place of one large valve. In either case, relieving capacity of different type valves of a given pipe size will vary substantially due to variations in construction.

According to the question, L. W.'s boilers are equipped with 6-in. nonreturn outlet valves. No information is given as to size of the steam pipe leading from boiler to the main steam line. If the pipe now used between each boiler and the main is of a standard 6-in. size, it is possible that he will be able to continue using this pipe together with his 6-in. nonreturn valve for evaporation ratings up to about 200 per cent. If the steam pipe is smaller than 6-in., it should be checked very carefully along with the steam demand to make sure losses in the line will not be excessive.

If L. W. uses both of his boilers at a 200 per cent rating, the main steam line should be 8-in. or larger depending on length of the run and permissible losses. Size of the steam main should be checked carefully together with maximum steam demand to make certain that losses in the line will not be excessive.

Two-thirds of L. W.'s heating system that is now gravity return should be satisfactory as it now exists, if present performance is satisfactory. Change in pressure of the boiler as proposed should not alter conditions so that it would be necessary to install a vacuum return system.

Minetto, N. Y. WILLIAM H. BRITT

Answer No. 505

How Much Steam to Heat Molasses?

Wayne Figures It

WITH RESPECT to heating molasses with steam, the questions raised are: —

1. How much steam is required to heat 500 tons of molasses from 50 F to 100 F in 10 hr with the boiler operating at 125 psig? Iron pipe will be used for a submerged heating coil and natural circulation only will be available.
2. How many square feet of heating surface are required?

Heating a fluid from a low to a higher temperature causes an unsteady state of heat transfer, since the heat or temperature head is constantly changing. To properly solve a problem of this type requires preparation of time-temperature charts, which involves the application of the Fourier equation for unsteady heat now. This type of solution is beyond the means of the average engineer and because of this, heat transfer calculations of this type are usually based on the assumption that a steady state exists, i.e., the heat or temperature head remains constant. Based on this premise, the following is offered as a guide to VG: —

Flow of molasses is:

$$\frac{500 \times 2000}{10} = 100{,}000 \text{ lbs per hr}$$

From the Cane Sugar Hand Book, Spencer and Mead, the estimated specific heat of molasses is 0.50 Btu per lb per deg. F. (The specific heat of molasses varies inversely with the sucrose concentration; 0.50 is an average value.)

Estimated required heat input = $100{,}000 \times 0.50\ (100 - 50) = 2{,}500{,}000$ Btu per hr.

Assuming 125 psig saturated steam available at the coil (pressure drop and condensation not considered), the latent heat of vaporization is 868.2 Btu per lb. Therefore, required steam equals: —

$2{,}500{,}000 \div 8682 = 2880$ lb per hr

Due to varying chemical constituents and solution concentration, it is recommended that the system be designed for 100 per cent over the above or 5000 lb steam per hour. A control valve, automatic or manual, installed in the steam feed line will adjust the steam flow to suit the heating requirements.

A conservative value for the overall coefficient of conductivity of iron pipe, considering scale deposits on the inner and outer pipe wall, and liquid and vapor films, is 100 Btu per hr, per sq ft per deg F.

For heating coil of the type contemplated, the logarithmic mean temperature difference (LMTD) is required for determining the required heating surface.

$$\text{LMTD} = \frac{(353-50)-(353-100)}{\log_e \dfrac{(353-50)}{(353-100)}} = 278 \text{ F}$$

Therefore the estimated required heating surface $= \dfrac{2{,}500{,}000}{100 \times 278} = 90$ sq ft

Again, based on experience, where chemical composition and concentration of solution varies over a wide range, it is suggested 100 per cent additional heating surface be added to the calculated value and design the coil to have 200 sq ft of surface.

For 200 sq ft of heating surface, estimated total length of iron pipe for different pipe sizes are given in the following tablulation:

Nominal Pipe Size	Req'd Pipe Length ft per sq ft	Total Req'd Pipe Length, Feet
½ in. Std Wt	4.547	909.4
¾ in. Std Wt	3.637	727.4
1 in. Std Wt	2.904	580.8
1¼ in. Std Wt	2.301	460.2
1½ in. Std Wt	2.010	402.0
2 in. Std Wt	1.608	321.6
2½ in. Std Wt	1.328	256.6
3 in. Std Wt	1.091	218.2
4 in. Std Wt	0.848	169.6

While the unit cost of the larger diameter pipe is greater, the required length is less, which permits lower fabricating cost. It is suggested VG receive quotations from the fabricator for furnishing the heating element in different pipe diameters and select a proper pipe size accordingly.

It is further suggested VG consider the use of hot water as a source of heat rather than steam. Due to the varying chemical composition of molasses and operating without agitation other than natural convection, it is possible to have carbonizing occur on the outside of the heating coil. Use of hot water provides a better means of control.

The investment for a hot water system will be greater, since it requires a hot water heater (steam as a source of heat), water circulating pump and additional piping, valves and fittings. Operating cost will be greater because of the energy requirements for pumping the hot water. However, the improved operating performance may more than offset this higher first cost.

Brooklyn, N. Y. H. B. WAYNE

"And why in hell can't the recorder just be turned upright — or didn't that ever occur to any of you geniuses?"

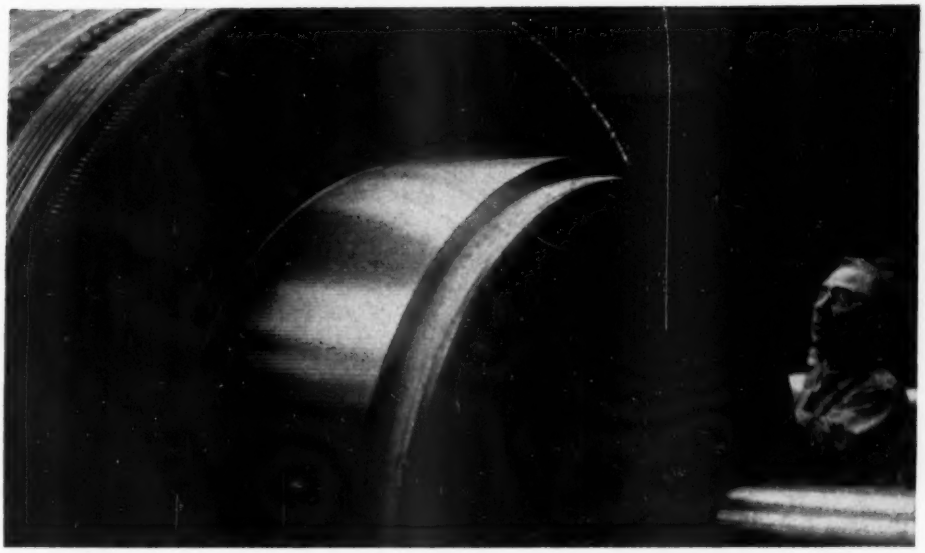


Fig. 1. Putting the finishing touches on a large commutator for a direct-current generator. One of first steps in prevention of flashover is a smooth, perfectly true commutator

Why D-C Machines Flash Over

Interesting study made at the Naval Research Laboratory shows that flashing at the brushes of direct-current motors and generators under short circuit originates in the arcing due to bouncing of the brushes and spread of ionized gas around surface of the commutator

FLASHING at the brushes of commutating machines has been a problem that has plagued operators for many years. The flashing of direct current generators and motors results from various causes including obvious defects such as open or short circuited coils, grounds, high bars, rough commutators, etc. Assuming the machine to be in good condition, however, flashing can still result from overload currents. High bar-to-bar voltages in conjunction with carbon dust, and sudden removal of load are among the generally accepted causes of flashover. Bouncing of the brushes is another important factor, since this involves the initial arcing that produces ionization of the air and final flashover.

In order to throw more light on this rather involved phenomenon, an interesting study was made recently at the Naval Research Laboratory in Washington, D. C. by A. T. McClinton and J. P. O'Connor. The purpose of this study, which was reported at the winter meeting of the American Institute of Electrical Engineers in January, was to investigate the flashover characteristics of d-c machines during transient overloads.

Two machines were used in these experiments; one a 300-kw, 345-v, 1200-rpm generator and the other a 90-hp, 250-v, 1800-rpm motor, which was operated as a generator. The electrical connections and instruments used are shown in Fig. 2.

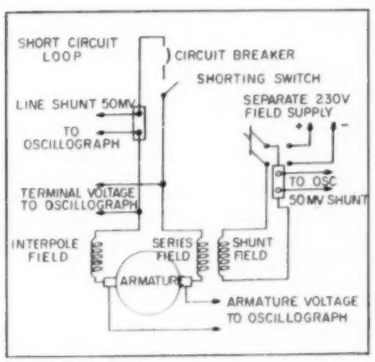


Fig. 2. Schematic diagram of the power and metering circuits used in test at Naval Research Laboratory in studying the flashover phenomena

Results of Overload

Flashovers were detected from oscillograms, taken of voltage and current of the armature. Flashing manifested itself by irregularities in the current and voltage traces, whereas the absence of flashing produced a smooth curve.

When a d-c generator is subjected to an overload, there is a shift in the point of commutation from the brush axis to an axis away from the direction of rotation. If the overload is of short-circuit magnitude, the point of commutation always appears to shift to a point beyond the brush edge, thus causing arcing. It is this arcing current which establishes the conditions for flashing but it must be distinguished from the flashing current itself. Now let us examine this arcing current in more detail.

Arcing current is caused by imperfect commutation and is in the reverse direction to flashing current. This is illustrated in Fig. 3. The cur-

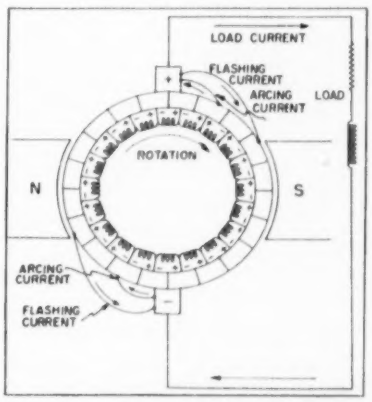


Fig. 3. Commutation during short circuit showing arcing and flashing currents at brush arc point

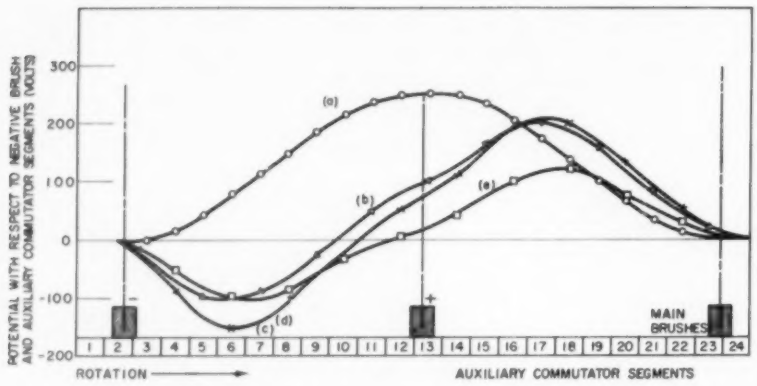


Fig. 4. Voltage distribution for various times during short circuit. Initial conditions: 250 v, no load, 1750 rpm, 90-hp motor when operated as a generator

Curve	Time (sec)	$i\hat{a}$ (pu)
a	0.0	0.0
b	0.005	5.0
c	0.01	8.5
d	0.02	8.5
e	0.20	5.9

rents resulting from brush arcing extend a few segments beyond the trailing edge of the brush, at which point the arc will be extinguished when the voltage from brush to commutator is less than that required to sustain the arc. There is also a position beyond this point at which the voltage will be zero.

Effect of Ionized Gases

Ionized gases, however, resulting from the brush arcing, will be carried around the commutator by the rotating film of air over the surface. Thus, the arcing current does not carry around to cause flashover, but the ionized gases that exist may result in the production of flashover, if sufficient voltage exists between brushes or brush to commutator to sustain an arc under the conditions of ionized gases then existing.

The voltage between adjacent brushes at peak current for low resistance short circuits, can be as much as 50 per cent of the initial terminal voltage of the generator. On a 300-v machine, the commutator voltage can easily be as high as 150 v. This is illustrated in Fig. 4, where the voltage distribution on the commutator is presented at several instants of time during a short circuit test. Data obtained by other investigators indicate that the voltages shown are sufficient to produce flashover when considered in conjunction with the ionized film of gas existing over the surface of the commutator.

The curves of Fig. 4 were obtained by plotting the bar-to-bar voltages as measured on an auxiliary commutator having half the number of segments as that of the main commutator. Each segment of the auxiliary commutator was connected through a 1600-ohm resistance to each alternate segment of the main commutator to prevent shorting the main commutator when the auxiliary brushes were in a position spanning two adjacent bars.

Voltages Between Segments

An inspection of curves c and d of Fig. 4 will show that the voltages of all the segments on the main commutator corresponding with segments 3 to 10 on the auxiliary commutator are negative with respect to the negative brush and that the voltage available to maintain an arc between the negative brush and a commutator segment increases in the direction of rotation to commutator segment 6.[1]

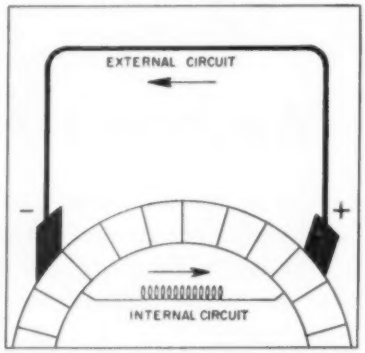


Fig. 4A. Diagram showing the internal and external circuits with respect to the brush polarity

Advancing in the direction of rotation, it will be seen that there is a decrease in voltage between the negative brush and commutator from segment 6 to 10. At segment 10, the voltage to the negative brush is 0. In the region between segment 10 and the positive brush, the voltage is positive with respect to the negative brush, and hence the current in any arc between this region and the negative brush would be in the opposite direction to the current in the previously mentioned arc.

By referring to Fig. 3, it will be noted that as the ionized gases are swept around the commutator, they extend across a greater potential difference. When this potential difference is high enough, the arc will strike, thus establishing the flashing current. As the commutator continues to rotate, this may be carried near the brush of opposite polarity. It should be noted that flashing can also occur between commutator segments.

The exact time required to establish the necessary conditions for flashing and ultimately complete flashover is not clear. A certain degree of randomness, no doubt, exists, but three factors are obviously involved. The first is the commutator voltage, second, the quality of commutation during the first instant of short cir-

[1] Editor's note: This statement concerning the polarity of the voltage with respect to the brushes may be confusing unless the internal and external circuits of the generator are properly visualized. From Fig. 4A it will be noted that the current through the generator winding is in the reverse direction, with respect to the brushes, to the current in the external circuit. In the external circuit, the electricity flows from the positive to the negative brush, while in the internal circuit the current is from the negative to the positive brush.

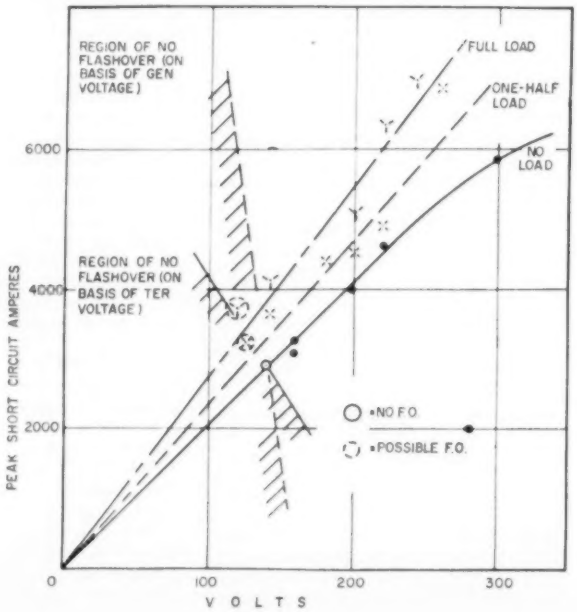


Fig. 5. Effect of initial load on generator flashing as detailed in text

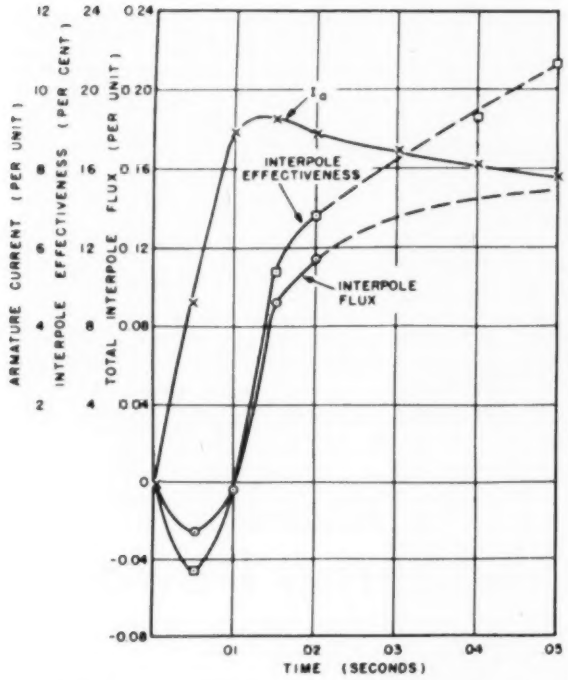


Fig. 6. Interpole flux during transient armature current. Initial conditions: 250 v, no load, 1800 rpm, 90-hp motor operated as a generator, iron interpoles

$$\text{Interpole effectiveness} = \frac{\text{Actual interpole flux}}{\text{Interpole flux for normal Commutation}} \times 100$$

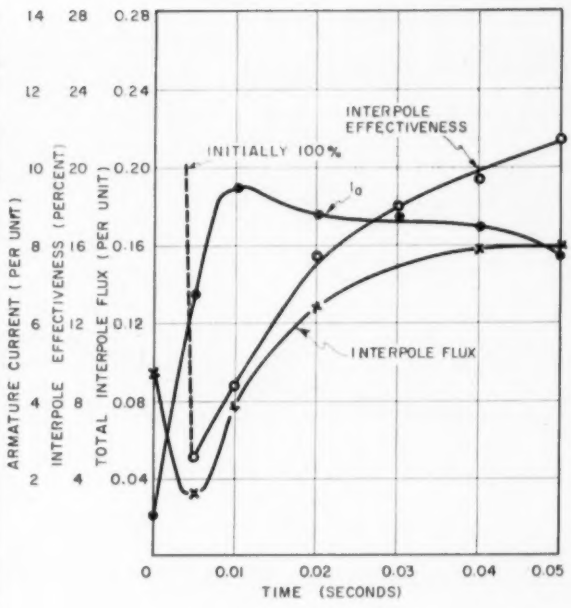


Fig. 7. Interpole flux during transient armature current. Initial conditions: 250 v, full load, 1800 rpm, 90-hp motor operated as a generator, solid iron interpoles. With full-load starting current, the commutation is improved

$$\text{Interpole effectiveness} = \frac{\text{Actual interpole flux}}{\text{Interpole flux for normal Commutation}} \times 100$$

cuit, and third, the speed of rotation. The speed of rotation enters because it determines the time required to spread the ionized gases over the commutator to the regions of higher potential difference.

Results obtained in the investigations at the Naval Research Laboratory substantiate this concept of flashing time. Without attempting to show the actual technical data, it was found that there was considerable randomness in the flashing time. At the higher voltages, however, which represent more severe flashing conditions, the time of flashing approached values of approximately 0.008 and 0.010 seconds for 1200 and 1015 rpm respectively. This time is closely equal to the time required for a commutator segment to rotate between brushes of opposite polarities.

Susceptibility to Flashing

Operating conditions may have a considerable effect on the susceptibility of a machine to flashover. The effect of initial load is indicated in Fig. 5. It will be noted that threshold value of terminal voltage, for no flashover, decreases with increased load, indicating an increased susceptibility to flashing. This relation is due to the higher short circuit currents associated with increased initial load, which in turn, increases the ionization.

The speed of rotation also has a pronounced effect on the susceptibility to flashing. Tests showed that there was an increase in threshold voltage for no flashover, with decrease in speed, but this was accompanied by an increase in transient load current. This, it was felt, was due to two factors; one, the improved commutating ability of the machine at lower speed due to the reduction in reactance voltage and two, the increased time for the ionization of gases being swept around the commutator from the region of arcing to the higher potential zones, where flashing currents are possible.

Experiments with brush shifting were found to substantiate the theory that brush arcing plays an important part in flashings. Shifting the brushes against the direction of rotation increases the brush arcing over that with the brushes on neutral, whereas a shift in the direction of rotation, will reduce the brush arcing.

With regard to interpole flux, it is well known that the interpole flux is insufficient to give satisfactory commutation during high armature currents due to saturation effects. The most generally accepted belief is that the magnitude of this flux, in a conventional machine under short circuit, will be comparable to that obtained at rated load. Experimental evidence presented in Fig. 6 reveals that this is optimistic during the early part of the transient load change. Eddy currents within the solid iron interpoles prevent the flux from following the rapid change of interpole current prior to the conditions of saturation. Thus, it is seen that the reactance voltage of the coils, undergoing commutation, is not compensated by interpole flux even during the early rise of armature current. Therefore, arcing conditions will prevail during the rise of armature current when reactance voltage overcomes the effects of resistance commutation.

The lag of interpole flux behind the transient armature current can be partially compensated for by starting at full load current with the resulting effectiveness shown in Fig. 7. It is to be expected that commutation will be improved and that the generator will be less susceptible to flashovers all other factors being equal.

Thus, to summarize this investigation of commutation in a generator, during transient overloads, three points stand out. These are, 1. Flashover develops from ionized gases, resulting from arcing, and is carried across from one brush to the next by the commutator segments. 2. The minimum time for flashover is approximately equal to the time required for a commutator segment to rotate between adjacent brushes. 3. The commutation flux from interpoles lags behind the transient interpole current and has a harmful effect on commutation. This flux is negative or near zero during the rise of armature current to its peak value. Laminating the interpole will improve this condition measurably.

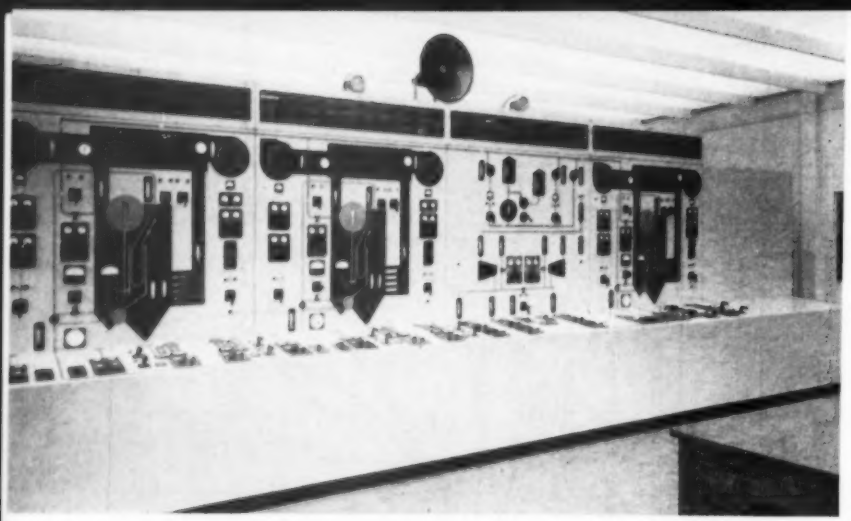


Fig. 1. In central contro room of modernized Hawthorne power plant, this colored diagrammatic boiler control panel centralizes automatic combustion control and instruments for 3 new boilers. Miniature indicators are included in diagrams; control adjustments on bench board; annunciators at top of panel. Directly opposite (not shown) is electrical control panel for the entire power plant

By

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Modernization of Hawthorne Power Plant Yields Big Savings

Expediting construction schedule saved about $900,000 in earlier availability of operating savings. New equipment replaced old on schedule that met load requirements throughout job and completed the installation of equipment 2½ years sooner than anticipated

EXPEDITING construction schedules for power plant rehabilitation projects can mean important savings. During the recent rehabilitation of the plant serving Western Electric's Hawthorne Works in Chicago, reductions in construction time saved over a million dollars — $300,000 through lower contractors' overhead, and $900,000 through earlier realization of operating savings. The plant met all load requirements throughout the construction period. This article describes how careful planning during construction made the savings possible.

During the 40 years of manufacturing at the Hawthorne Plant in Chicago, the various forms of energy necessary for manufacturing have been sufficiently diversified to justify local generation of electric power. In 1948 these requirements had increased to better than 650,000 lb per hr for steam and 26,000-kw for electric power. Steam requirements for manufacturing included those necessary for space heating, fresh air heating, compressed air generation, in addition to steam going directly to process. These demands, with those for electric power generation, were supplied by 14 stoker-fired boilers operating at 175-psig, 500-F, located in the main power plant with a total capacity of about 650,000 lb per hr, together with 2 similarly fired units furnishing steam for the 26th St. Plant at 160-psig and 415-F, capable of generating about 60,000 lb per hr. Electric power was generated by 7 condensing turbine generators in the main plant with a total capacity of 37,000-kw.

In June 1950, funds were appropriated for the rehabilitation of the main power plant. Two factors made such a course necessary: high power costs, and condemnation of the two boiler units serving the 26th St. plant. Engineering investigation basic to the granting of funds had shown purchase of utility power to be uneconomical because of the diversity of

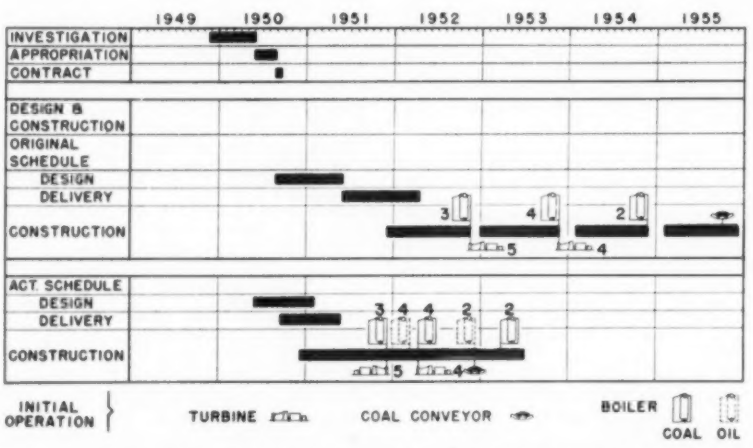


Fig. 2. Construction progress chart showing, in center, original schedule and, at bottom, schedule actually carried out, resulting in $900,000 saving in earlier availability of operating savings, explained in text

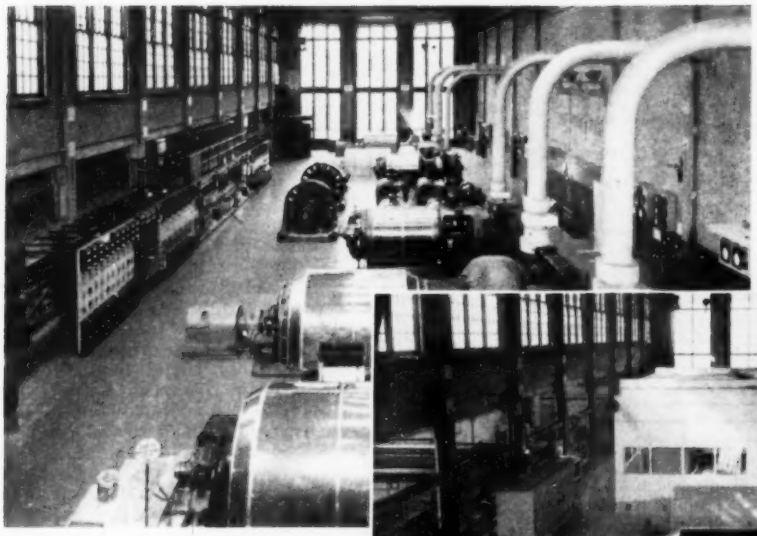
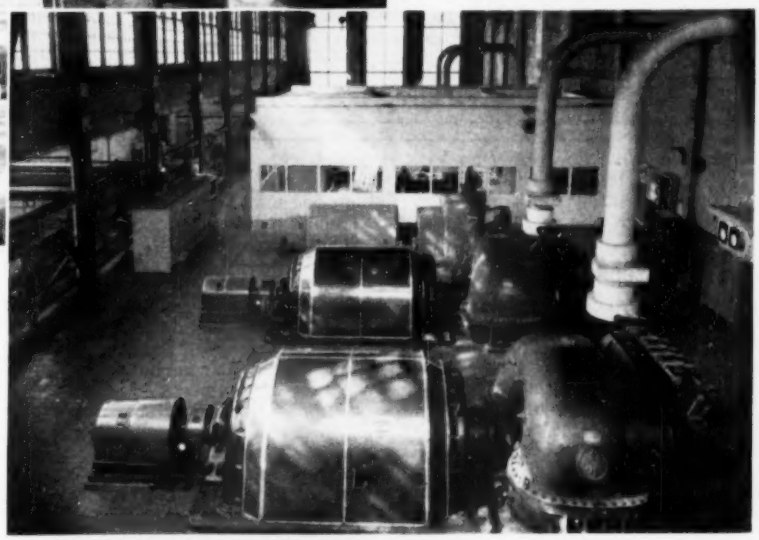
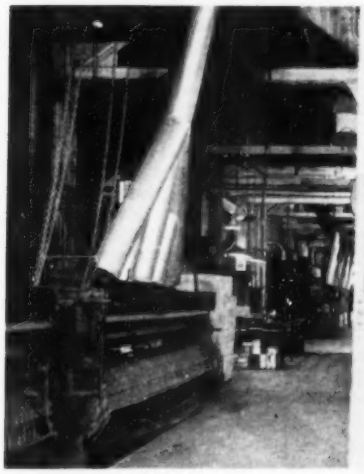


Fig. 3.—Left. View in Hawthorne power plant turbine room in 1950 before modernization program was begun, showing several of the generators

Fig. 4.—Below. View in modernized turbine room, taken in February, 1953. Enclosure in approximate center of room is central control room where all boiler and electrical controls for entire plant are now centralized. This is one of first industrial power plants to centralize control on diagrammatic panel



the energy demands. For these reasons, it had shown the advisability of turbine generators superposed over the existing 170-psi 500-F generating system. It had also indicated the economies of generating 26th St. steam in the main boiler plant and supplying this location, about 2500 ft distant, through 170-psi 500-F distribution lines. To reduce maintenance and operating costs, it was



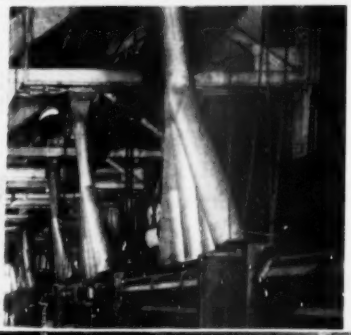
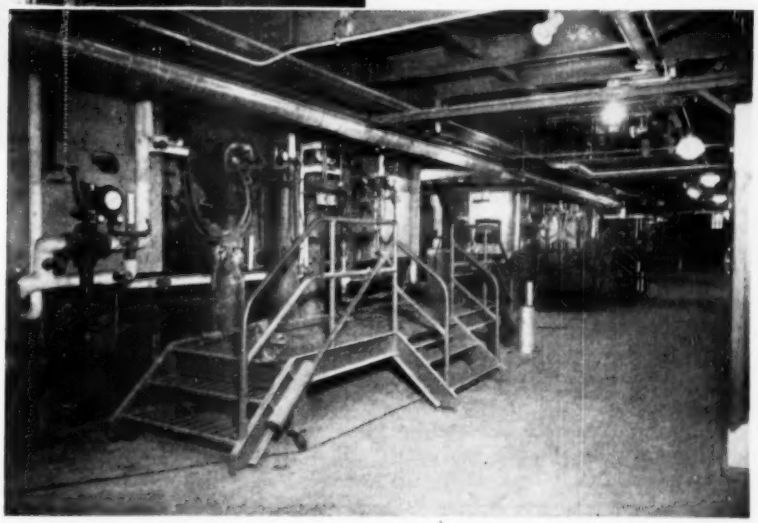


Fig. 5.—Left. View in firing aisle of former Hawthorne power plant boiler room in 1950 before modernizing, showing some of stoker-fired boilers

Fig. 6.—Below. View in firing aisle of Hawthorne plant in January 1953, showing lower burners and accessories of the new 150,000-lb-per-hr boilers



decided to include installation of modern coal handling equipment, a central control room, and replacement of obsolete high- and low-voltage switching equipment.

To accomplish these ends, it was necessary to remove 14 stoker-fired boilers in the main plant and replace them with three modern steam generating units for operation at 900 psi and 830 F. As there is no connection with any outside source of power, dependable operation during the construction period was necessarily a foremost consideration. Reference to the old and new floor plans and cross

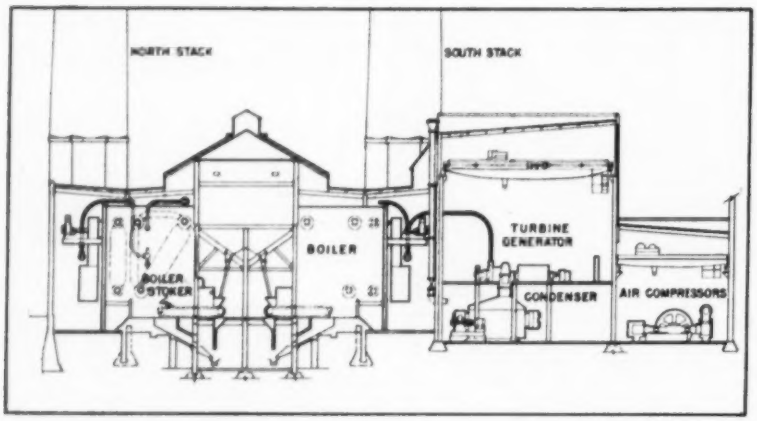


Fig. 7.—Left. Cross-section of former Hawthorne power plant, looking east, before modernization

sections shown respectively on Figs. 7, 8, 9 and 10, together with the list of equipment installed, will show why the boiler plant offered the most serious problem in this respect. Two 170-psi turbine generators with a total capacity of 6250-kva were replaced with two units of this capacity, each operating at 850 psi 825 F and exhausting at 170 psi 500 F. A two-bed demineralizing system was installed in the space formerly occupied by the acid sodium zeolite treatment plant. About two-thirds of the 12-kv switchgear was replaced, together with transformers and other gear furnishing 440-v power for plant auxiliaries. While these latter replacements were of a major nature, the boiler replacements required the most planning and careful scheduling.

Before requesting appropriations, a schedule had been worked out to maintain a total of old and new capacity on the line at all times that would be adequate to meet load requirements. This schedule together with all calculations were checked and approved by a firm of consulting and contracting engineers before appropriations were requested. In this scheduling, the lower non-heating season steam load provided periods that were necessary in order to meet the above requirements. The time separating such periods, however, caused the schedule to cover a period of about 5 years. This schedule is shown on Fig. 2 together with the one actually followed.

Delivery of boilers was the controlling factor in this planning. It was originally thought a 9-month design period would be necessary before these units could be ordered and that their delivery would require about one year. On this basis, construction could have started in November 1951. With removal and installation of units so arranged that at no period would there be less total capacity on the line than would adequately meet load requirements, the availability of the new equipment would have been as follows: The first high-pressure steam generator and turbine about November 1, 1952, with the second high-pressure unit following about one year later. The third high-pressure steam generator would have been available in the latter part of 1954, with the coal handling equipment ready for service about 1955.

At load levels as they existed at that time, it was estimated that operating savings after fixed charges of somewhat more than $1,000 per calendar day would be possible. It was therefore apparent that any improvement in schedule would result in a considerable saving in operating costs. An attempt was made to secure such improvement, and the result is shown at the bottom of Fig. 2.

At the top of the above chart, Fig. 2, the time necessary for investigation, securing appropriations and selection of engineers is shown. From the time the appropriation was requested until the engineers were selected covered about four months. During this period, in order to save

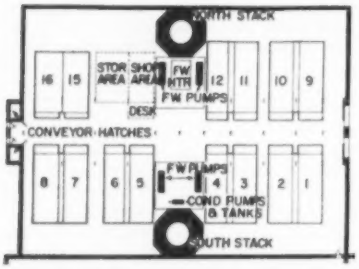


Fig. 8. Firing floor plan of old plant boiler room

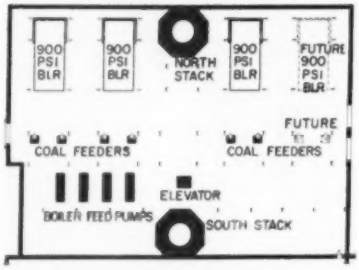


Fig. 9. Firing floor plan, modernized boiler room

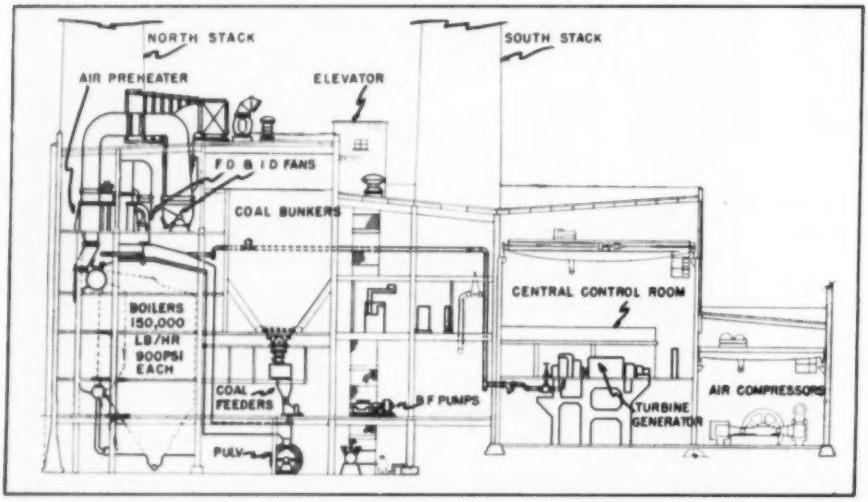


Fig. 10. Cross-section, looking east, showing arrangement of principal equipment in modernized power plant at Hawthorne works of Western Electric Co. New boilers are all in row at left, leaving space for plant auxiliaries, pumps, heaters and the like in center and centralized control room and new turbine generators at the right as in Fig. 4

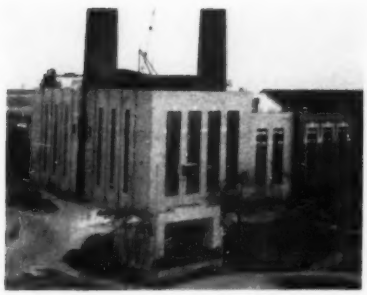


Fig. 11.—Above. Exterior view of modernized Hawthorne power plant as it appears at present

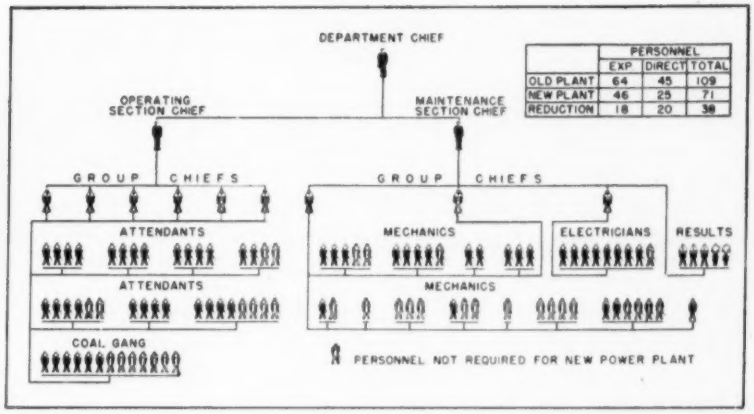


Fig. 12.—Right. Chart showing personnel reductions possible by Hawthorne power modernization

time, Western Electric personnel were proceeding with the preliminary design. This made it possible to write boiler and turbine specifications, have prices from the manufacturers, and to place orders for the boilers the day following contractor's availability as a purchaser.

Boiler deliveries were improved by about 5 months, and on this basis construction was started in November 1950. The earlier completion of boiler and turbine designs, together with improved deliveries, made it feasible to remove low pressure boilers Nos. 15 and 16 during the summer of 1951. Following their removal and before the first high-pressure steam generator was in service, the total capacity in the boiler room barely met peak requirements, and oil burning equipment was installed under two incinerator boilers for protection.

With the availability of the first high-pressure turbine on December 5, 1951, it was evident that utilization of process steam for high-pressure demand had greatly reduced the overall steam required. From its original operation on the above date, both the steam generator and turbine generator were highly dependable, and it was decided to remove the old low-pressure boilers Nos. 7 and 8 in February 1952. After their removal was begun, if either the high-pressure boiler or turbine had failed before the second high-pressure steam generator was ready for operation, it would have been necessary to reduce the plant load by about one-half. This risk seemed justifiable in view of the resultant savings, and no load curtailment was necessary.

It was possible to install a steam generator in the space occupied by two old low-pressure units, but in order to provide bunker capacity for burning coal, the two old units across the aisle had to be removed. At present market, coal is the most economical fuel, but in order to expedite the schedule the second of the two high-pressure units was operated on oil in order to make its capacity available during the four months necessary for the installation of bunkers, and thus compensate for the old equipment that had been removed. On the basis of the new schedule the first high-pressure boiler went in service about one year sooner than was anticipated, with the second unit available for oil operation some 20 months sooner than was shown in the original schedule. The third high-pressure unit was available about 2 years in advance of the forecast date of operation, and the coal handling equipment about 3 years earlier than expected. The termination of the project was advanced about $2\frac{1}{2}$ years. The contractor's over-head for the project was reduced about $300,000. The earlier availability of operating savings with the new schedule amounted to about $904,000. Figure 2 shows graphically how this result came about.

List of Principal New Equipment, Hawthorne Works Power Plant

Western Electric Co., Chicago, Ill.

STEAM GENERATION

Steam Generators—Three pulverized coal, oil and natural gas fired radiant boilers; 1000-psi design, capacity 150,000 lb per hr at 900-psi 830-F with feedwater at 210-F. Maximum capacity 200,000 lb per hr. Each unit served by one Ljungstrom air heater and two Atrita pulverizers. Riley Stoker Corp.

Boiler Feed Pumps—Three 500-gpm, 2700-ft TDH, 210-F water units, 2 motor-driven and one steam turbine driven. Ingersoll Rand Co.

High-Pressure Feedwater Heater—One horizontal, 4-pass U-Tube-type heater designed for 1400-psig water pressure, 600,000 lb per hr capacity, supplied with steam at 170-psig 500-F. Resultant water temperature 360-F. Griscom-Russell Co.

Fans—Induced-draft, 129,000 cfm at 18 in. static, 324-F, hydraulic coupled to 875-rpm motor drive. American Blower Corp.

Forced-draft, 74,500 cfm at 10.5 in. static, 100-F, direct-connected to 690-rpm motor drive. American Blower Corp.

Dust Collectors—Type ST with secondary collectors. American Blower Corp.

Soot Blowers—Automatic sequential air control, using steam as cleaning medium. Diamond Power Specialty Corp.

Ash Removal System—Pneumatic with mechanical and steam exhausters, dustless unloaders, and storage bin. United Conveyor Corp.

Automatic Combustion Control—Electronic-Pneumatic-System. Republic Flow Meters Co.

Control Boards—

Boiler	Panellit, Inc.
Generator and 12-kv distribution.	General Electric Co.

Piping Systems—

Fabricator	Pittsburgh Piping & Equipment Co.
Erector	William A. Pope Co.

ELECTRIC POWER GENERATION

Turbine Generators—Two 5,000/6250-kw non-condensing, 850-psig 825 steam, exhausting at 170-psig 500-F. Generators, 3 phase, 60 cycle, 12,500 v. General Electric Co.

Switchgear—23—12-kv, 500,000-kva IC air circuit breakers; 4—3-phase 750-amp 625-kva reactors; 1—synchronizing bus. General Electric Co.

Substations Serving Auxiliaries—

2—2,000 kva, 12 kv/2400 v boiler auxiliaries.
1—1,500 kva, 12 kv/2400 v boiler auxiliaries.
1—1500/1750 kva, 12 kv/2400 v emergency. Westinghouse Electric Corp.
2—500 kva, 2400 v/480 v boiler room auxiliaries.
2—1000 kva, 12 kv/480 v turbine room auxiliaries. General Electric Co.

Motor Control Centers—

3—480 v for boiler auxiliaries.
2—480 v for misc. boiler room auxiliaries.
1—480 v coal handling.
3—480 v turbine auxiliaries. Allen Bradley Co

COAL HANDLING SYSTEM

10-burner gas thaw pit. Hauck Mfg. Co.
Car Shaker. Allis Chalmers Mfg. Co.
200-tph System including:
2—double rolling ring crushers; 2—belt conveyors from crushers under track hoppers to two flight conveyors elevating coal to single belt. This single belt to transfer belt in center of boiler room. Discharges on either one of two shuttle belt conveyors. Stephens-Adamson Mfg. Co.
Coal Scales and Bunker Valves. Stock Equipment Co.

WATER TREATMENT

Chlorination—For treatment of condenser cooling water. Sodium hypochloride solution storage tank and feeder. Proportioneers, Inc.
External Feedwater Treatment—Duplex 2-bed demineralizer system with degasifier. Infilco, Inc.
Internal Feedwater Treatment—4 proportioning pumps for feeding sulphite, phosphate, and hydroxide solution. Milton Roy Co.

Engineers & Contractors, United Engineers & Constructors, Inc.

Silicones Help to Assure Accurate Power Control

By L. G. FRIEDLE

Superintendent of Control, Power Department, The Dow Chemical Co.

Dow Chemical takes Dow Corning medicine:—silicone lubricants for regulators, diaphragm valves and components adversely affected by heat and cold in control systems at South Power Station. Results:—Lower maintenance cost, greater control accuracy and reliability

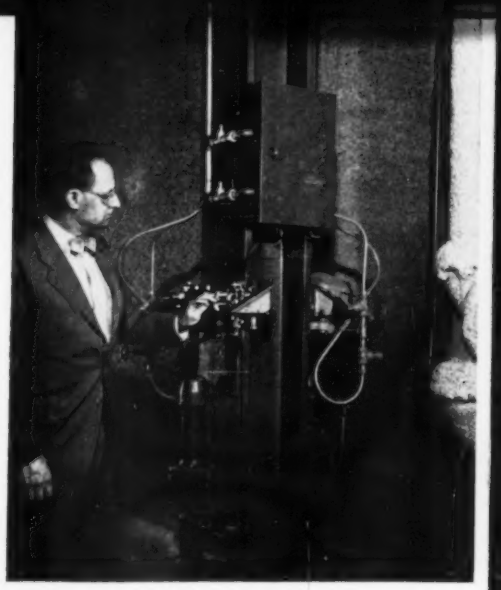


Fig. 2. Author L. G. Friedle indicates how dashpot on flow measuring unit makes use of the silicone fluid

Fig. 1. On cyclone-fired boilers at South Station, each cyclone has gas line for ignition in case of coal feed interruption. To assure positive control, solenoid-actuated diaphragm valves are mounted each side of solenoid vent valve. Valve stems and glands are lubricated with silicone, to assure smooth operation, prevent corrosion. For further lubrication:—the operators turn down packing screw ⅓ turn every month

DESIGNED by Dow engineers and built under their supervision, the South Station Power Plant has raised the total steam generating capacity of the Midland Plant of The Dow Chemical Co. at Midland, Mich. to 2,750,000 lb per hr and power generation capacity to 108,000-kw. The plant incorporates a 2-boiler unit for each turbine with the boilers regulated from a common master regulator. Steam is generated at 1250-psi, 830 F, and is utilized by a 3,600-rpm double-extraction back-pressure turbine generator. The South Station was described in detail in the September 1950 issue of POWER ENGINEERING.

The first completely pressurized, cyclone-fired steam plant in the country, South Station contributes 760,000 lb of steam per hr and 30,000-kw of electric power. Construction work is underway to increase this output by adding two 400,000 lb-per-hr boilers and another 30,000-kw turbine.

Silicones in Regulators

The $12,000,000 station is designed to be as near the ideal in operating convenience as possible within economic reason. An unusually complete automatic control system was installed, with special emphasis on consistent, dependable accuracy. Toward that end, silicone fluids and compounds were used for the first time in many standard assemblies. In many others, silicones were utilized after conventional materials proved unsatisfactory for our purposes.

Six months after the plant went on the line in June, 1950, for instance, trouble developed in the pneumatic positioning regulators. These units translate air pressure into mechanical movement by means of a leather piston in a relay cylinder. Installed on the coal feeders, the primary and secondary air dampers, and other parts of the control system, some of these regulators operated at tempera-

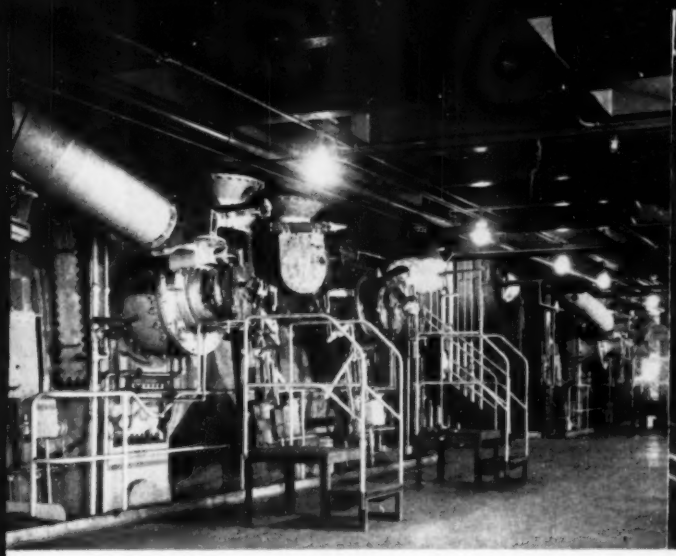


Fig. 3. Regulators for cyclone primary and secondary air dampers in temperatures up to 160 F. Relay cylinder cup leathers impregnated with silicone

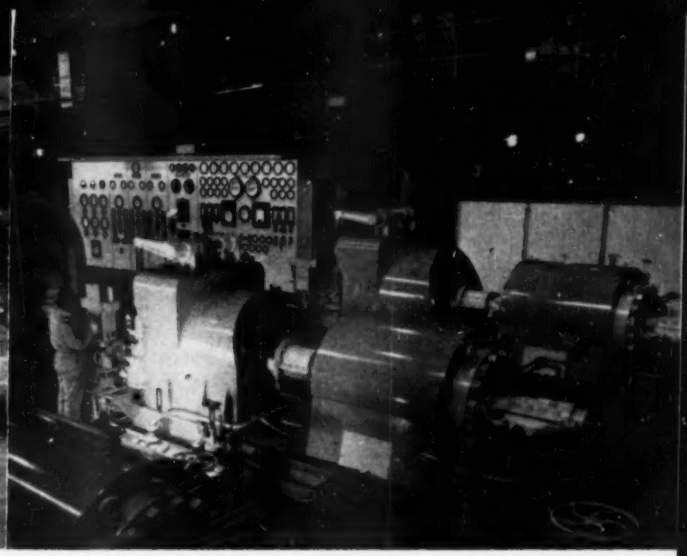


Fig. 4. Silicone-damped pressure regulators on two turbine-driven 1200-gpm feed pumps operate governor valves to maintain constant feed pressure

tures up to 160 F in these locations.

The twin leathers in each relay piston had been saturated with neatsfoot oil when installed. But the high-temperature service reduced it to a gummy residue, particles of which lodged between the hardened leathers and the cylinder wall. When air by-passed the pistons, of course, the regulators were useless.

Cup Leather Lubrication

We tried introducing small amounts of fresh oil into the relay cylinders, but to no effect. New cup leathers had to be installed on each unit.

The new cup leathers were not lubricated with neatsfoot oil, however. Instead, we used a light silicone oil, the clear, water-white fluid made by our associate, Dow Corning Corp. This fluid is remarkably resistant to temperature extremes. It stays liquid over a span ranging from −40 F to over 400 F, or at temperatures which either congeal organic oils or decompose them entirely.

The first silicone-soaked cup leathers we installed are still in use today, almost two years later. Their only maintenance attention consists of a few drops of silicone fluid introduced into the cylinders about once every six months.

As other cup leathers stiffened, they were replaced with silicone-saturated ones, until now all our regulators of this type are silicone-lubricated.

Saturating the leathers was quite simple. We simply soaked them for several days in a shallow dish filled with the silicone fluid, which had been removed from the dashpots of other controllers in South Station. Although unfit for further use as a dashpot medium without filtering, it made a perfectly satisfactory impregnant.

The dashpot-type regulators mentioned include controllers that are air-operated balance scale units with the dashpot acting as a stabilizer between the measuring element and the amplifier movement. These automatic regulators control the entire steam generation system from feedwater to desuperheating, subject, of course, to overriding controls from the master panel. Their plan of installation and operation is a major reason why South Station can generate 760,000 lb of steam and 30,000-kw of electricity per hr with an operating crew of only six men.

Dashpot Fluid

Careful preliminary investigation indicated that silicone fluid was the best dashpot medium available for these units, and it has been standard equipment since their installation. Although every effort is made to insulate the regulators from extreme heat or cold, even a small change in temperature tends to affect organic oils, reducing their efficiency as hydraulic couplings. Silicone fluid, on the other hand, has little tendency to thin or thicken with temperature, and it is also highly resistant to oxidation.

Only maintenance required is complete replacement, at infrequent intervals, when the fluid becomes contaminated with dirt or grit. Foreign material works into the regulators, even though they are totally enclosed and very rarely opened. These regulators, of course, could be made more dust tight by a gasket arrangement. However, the contaminated fluid is not a total loss. As previously mentioned, it is used to impregnate cup leathers in the pneumatic position regulators.

Diaphragm Valve Lubrication

We also use a silicone compound as a heat-stable and oxidation-resistant lubricant for various valves in the South Station. For instance, each of the cyclone furnaces is equipped with a gas ignition line to ignite the coal in case of coal feed interruption. To assure control on the gas lines, solenoid-actuated diaphragm valves are mounted on each side of a solenoid vent valve. The valve stems and packing glands of these valves are lubricated with silicone compound to prevent corrosion and assure smooth, immediate operation at any time. The valve stems were lubricated with this compound prior to installation in 1950. Subsequent maintenance has consisted of merely turning down the hexagon-headed packing screw a third of a turn, or "two flats," every month.

The same principle is involved in all the stem-lubricated diaphragm valves in the 4000-gpm demineralization plant, built to supply the 100 per cent make-up required for South Station's 1250-psi boilers and other uses. Most of these valves furnish automatic cycle control of influent and effluent from cation and anion exchangers, and flow control to deaerators and to storage. Others control acid flow from unloading through dilution, storage, use, and reclaim.

Demineralizer Control

Control in the demineralization process is so designed that these diaphragm valves, after a period of inactivity, are suddenly called on to operate in automatic sequence. Failure in any one valve will disrupt the entire system. Silicone-lubricated since installation, however, the valves operate with optimum ease and smoothness. The valves operate so freely, in fact, that maintenance consists of merely turning down the packing screw "two flats" once a month — by hand.

Flow recording, indication and integration for each of the 10 anion exchangers, water flow to the deaerators, and acid flow, are all measured by pneumatic differential pressure transmitters. A sensitive and precise instrument, the transmitter's damping device is made up of a thin "piston" operating in a dashpot no larger than a thimble. Here again,

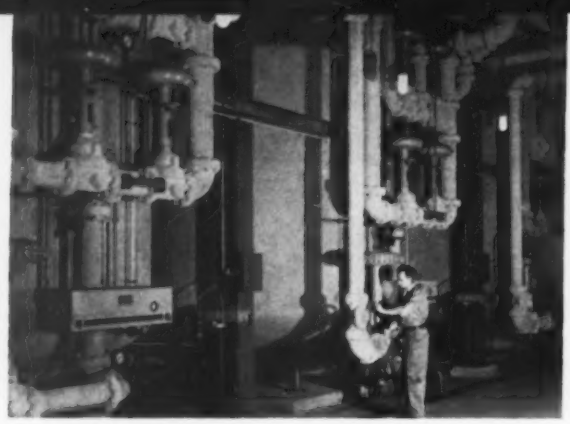


Fig. 5. In 4000-gpm demineralizing plant supplying 100 per cent make-up to South Station boilers, silicone-lubricated valves and transmitters are used

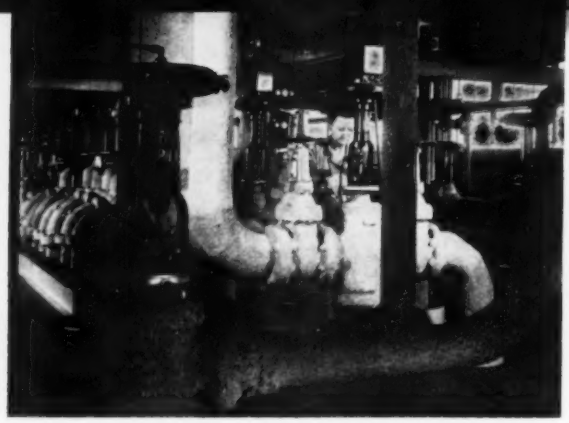


Fig. 6. In control of flows in demineralizing plant, diaphragm valves move in sequence. Failure of any valve disrupts sequence; silicone smooths operation

silicone fluid is used as the damping medium. Its heat stability is of little consequence, because the entire building is maintained at reasonable temperatures the year around. But its freedom from decomposition and its resistance to oxidation enable the instruments to transmit a signal of consistent accuracy.

On the other hand, temperature-stability played an important part in our switch to silicone lubricants in our coal preparation plant. Perhaps the best example is in connection with our car-thawing pits. There are six of these at South Station, each equipped with eight individually controlled gas burners and pilot lights. To ignite the pilots, we designed an automatic system consisting of a small synchronous motor, eight-point distributor, and 10,000-v transformer. At the turn of a switch, the motor turns the distributor cam once, relaying sufficient high voltage current to ignite each of the pilots in turn.

The first winter these units were in service, however, we encountered difficulty. Zero weather congealed the oil in the gearcase, slowing or, in some cases, stopping the motor. Moisture penetrated the distributor, disrupting the current flow entirely. More than once, the pilots were lighted by hand. This, of course, caused considerable trouble.

By the time the next winter arrived, the units had been completely cleaned and overhauled. The gearcases were filled with silicone fluid and the distributors were sealed with a silicone compound. We sprayed the cap and the ignition cables with a solvent solution of the silicone compound to prevent condensation from forming over their surfaces.

The entire system performed excellently throughout the second winter. Not a motor slowed down, despite bitter cold, and no moisture ever interrupted the high tension current flow in the distributors.

Much the same thing occurred in connection with the bin switches in our coal storage silos. The difference here is simply that these motors operate continuously, rotating a paddle at the end of a shaft extending down into the silos. When the coal level is high enough to stop the paddle, relays shut off the motor and automatically activate the main bin switch which releases a visible or audible signal and, after a given time, shuts down the unloading process.

Here again, cold weather hampered the operation of these motors and made them unreliable. And again, a complete cleaning and replacement of the original oil with silicone fluid effectively prevented any further recurrence of difficulty.

Silicones are generally considered to be quite expensive. We have found, however, that when consistently reliable and accurate control is at stake, the initial cost is a secondary consideration. In reduced maintenance costs and reliable operation, silicone fluids and compounds in the South Station and in its auxiliary buildings have paid for themselves many times over.

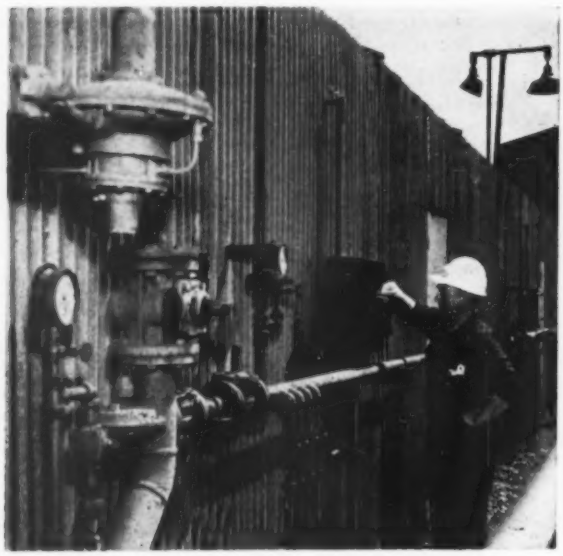


Fig. 7. Control station for each of six car-thawing pits at South Station. Ignition system silicone lubricated for dependability in freezing weather

Fig. 8. Pilot ignition for car-thawing burners has motor-driven distributor. Silicone on gears and distributor prevents sticking in freezing weather

Fig. 1. Speakers at the opening meeting of 1953 American Power Conference: (Left to right) R. D. Maxson, Commonwealth Edison Company; Charles Y. Freeman, Commonwealth Edison Co.; His Eminence Samuel Cardinal Stritch, Archbishop of Chicago; W. A. Roberts, Allis-Chalmers Mfg. Co.; W. A. Lewis, Illinois Institute of Technology; F. D. Carvin, Illinois Institute of Technology

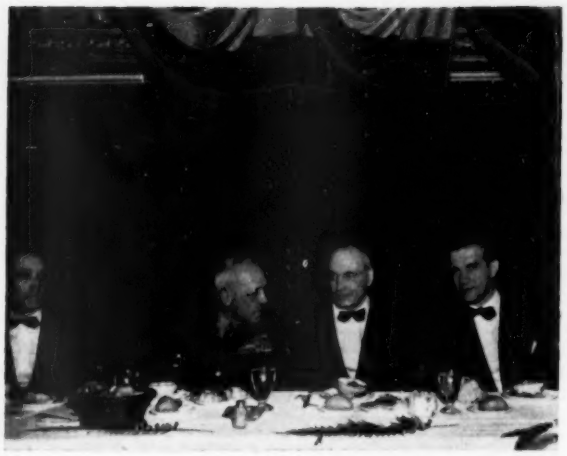


Fig. 2. View at speakers' table, All Engineers' Dinner, 1953 American Power Conference. (Left to right): Ben G. Elliott, University of Wisconsin; Lieutenant-General W. B. Kean, U. S. Army; Hon. Fred G. Aandahl, Assistant Secretary for Water and Power Development, U. S. Dept. of the Interior, principal speaker; John T. ReHaliata, President, IIT, presiding at All Engineers' Dinner

American Power Conference Looks Ahead to Great Power Progress

ATTENDED by 2500 of the country's leading power engineers from utility companies and manufacturing industries, the second American Power Conference was held March 25–27 at the Hotel Sherman in Chicago. The American Power Conference is the successor to the former Midwest Power Conference and this is actually the fifteenth annual meeting of the organization.

Highlights of the Conference, of special interest to power engineers, were discussions of: design and operating problems in large utility boilers and turbines; supercharged cooling and liquid cooling of large generators; an unusually practical group of papers on design and operating problems of industrial and institutional power and steam plants; a most instructive session on atomic energy; much discussion of the development work on the heat pump which will not only be a great electric load builder but also promises great improvements in heating and air conditioning systems; discussion of electrical transmission, distribution and application details; description of several unusual and interesting hydroelectric projects.

At the opening session, His Eminence Samuel Cardinal Stritch, Archbishop of Chicago, delivered the invocation; then addresses of welcome were delivered by Charles Y. Freeman and W. A. Lewis; and the principal address was delivered by W. A. Roberts, president of the Allis-Chalmers Manufacturing Co. He pointed out the great powers of electricity for good living, called attention to the expected population increases in this country, stated that these would necessitate installation of more and more electric generating capacity and predicted ever-rising standards of living based upon our technological developments.

At one of the luncheon meetings, H. P. Liversidge of Philadelphia Electric Co. called upon industry to assume more and more responsibility for making up the prevailing shortage of engineers.

At another luncheon meeting, B. L. England, president of Edison Electric Institute, reviewed the recent progress of the electric industry and the reasons for that progress.

The Honorable Fred G. Aandahl, Assistant Secretary for Water & Power Development of the United States Department of the Interior, reviewed the functions of the government in developing our water and power resources.

Atomic Power Prospects

The session on atomic energy, one of the best of the conference, heard W. L. Davidson discuss the subject "Why Atomic Power?" bringing out the idea that aside from the when and how of the subject, there are a number of reasons why we should try to go ahead now with the development of atomic power for industry. The engineering and technical problems involved in developing an atomic energy power plant were reviewed by Walter H. Zinn of the Argonne National Laboratory. Walker L. Cisler, president of the Detroit Edison Company, reviewed the economics of atomic energy, showed what his company's new St. Clair Electric Power Plant might look like if it incorporated nuclear reactors instead of coal-fired boilers.

Oscar M. Ruebhausen discussed the changes in the atomic energy act that might be necessary and desirable to make it meet present conditions, which are much different from those existing when the act was originally passed in 1946. The Honorable Carl Hinshaw discussed present day legislation relating to atomic energy and the entire subject was summed up by Murray Joslin of the Commonwealth Edison Co.

The general impression left by the speakers was that because of the changes in the whole atomic picture, the desire of industry to participate in atomic power development, and other factors, it would not be long before the door would be open to private industry to step into the atomic energy field, which, according to the present law, must now be controlled exclusively by the government.

Industrial Power Plants

Power and steam for industrial plants and various types of institutions were covered in an interesting session. John E. Hoeft, of National Container Corp., discussed black liquor, a paper mill fuel, showing how it has to be handled and burned to generate steam and recover valuable chemicals.

Nyle C. Austin, of Marathon Corp., reviewed the steam and power

(*Continued on page 108*)

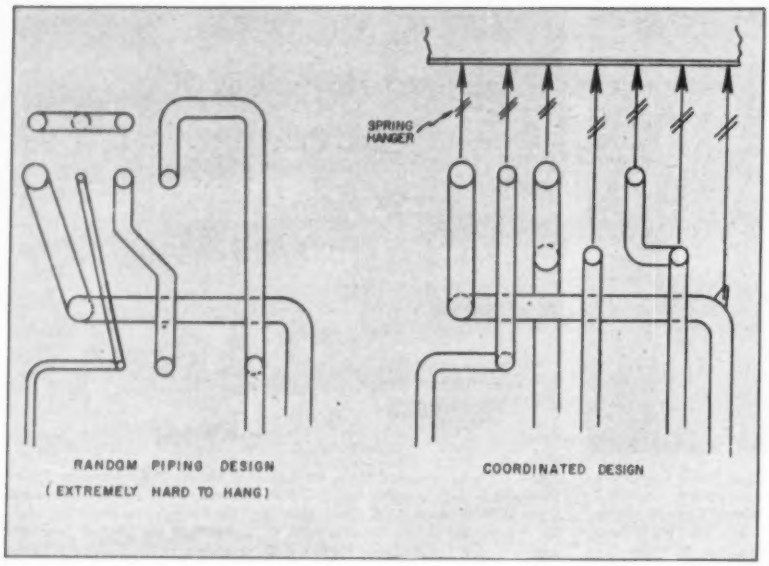


Fig. 1. Diagrams illustrating the right and wrong way to arrange supports for a simple piping system

Save H-P H-T Piping $$$

By HENRY DE SOTO
Consulting Engineer

In many modern power plants, piping layout design has not kept pace with improvements in other equipment. This article describes some of the features a designer must consider when laying out high pressure and temperature piping systems

IN MANY POWER PLANTS, the piping is an untidy tangle which is expensive to install, difficult to maintain, and ugly to look at. Some of these plants have the excuse that they were built in haste during the war; others that they were used to pioneer intricate reheating systems or develop outdoor station techniques; but most of the layouts are bad simply because they were designed by inexperienced men. The piping for a modern power plant is a difficult engineering job, and needs experienced and capable designers. Time and money spent on design pays off in lower installation cost and cheaper maintenance and ensures a neat installation. Fig. 1 shows right and wrong way to lay out simple piping system which can be supported easily and will look tidy once installed.

Years ago, one or two more fittings, or an extra few feet of pipe made little difference to the total cost of the installation, but with modern high pressures and temperatures, both piping and fittings are so expensive that every unnecessary item means a big increase in cost.

Figure 2 illustrates how money can be saved by good design. Calculations will often show that many long vertical outlets and expansion loops are unnecessary, which saves a lot of money when one foot of installed piping can cost as much as $400. Motor-operated gate valves in the headers are no longer considered good practice, and can be omitted, saving from $14,000 to $24,000 for each one. If the valves are eliminated, the inspection platforms for them do not have to be built, which means more money saved. These are just a few ways money can be saved by careful design.

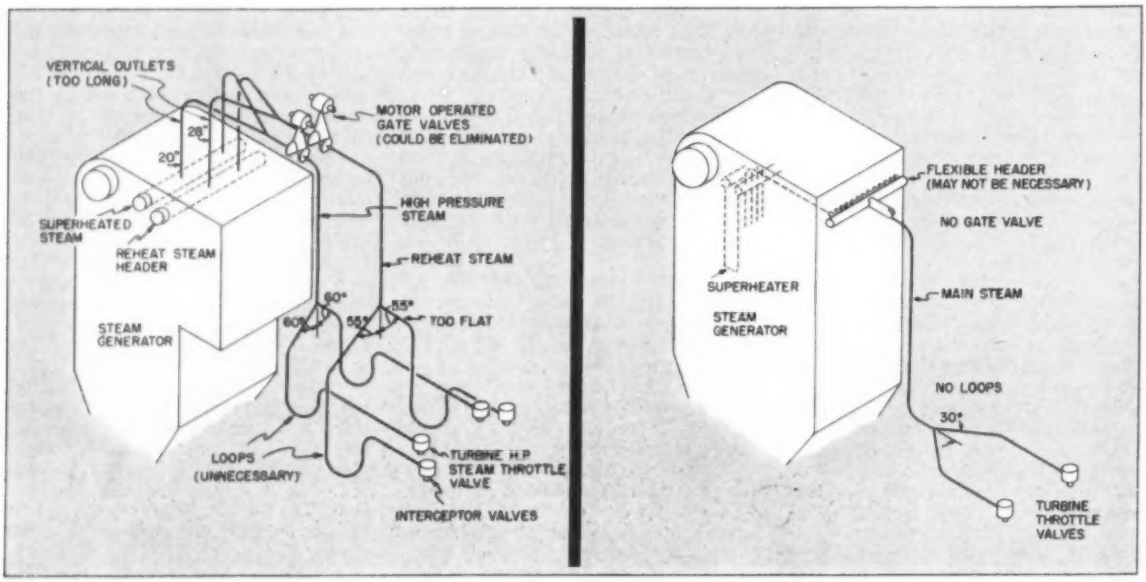


Fig. 2. Diagrams showing how unnecessary and expensive motor operated valves, loops, and other piping and equipment can be eliminated by careful design

Modern power plant practice demands a water conditioning program that produces only the ultimate in trouble-free and efficient boiler operation.

External softening and the use of conventional inorganic treatments are recognized requisites. However, the supplementary use of organic agents may well assure the difference between long, uninterrupted operation and frequent boiler outages due to scale and sludge formations.

Take the case, for example, of a large electrical manufacturer, who called in Betz 14 years ago to treat its new power plant. This plant operates at 900 pounds pressure with 50% make-up polluted river water. Betz recommended the use of organic agents to supplement the external softening and inorganic treatment.

Here are the results from the record: In the entire 14 years operation of these boilers, they have never been turbined or acid cleaned and no difficulties from feedwater conditions have occurred! What's more, excellent steam purity is produced and turbine blading is completely clean.

This plant could easily be your plant—operating efficiently, free from frequent boiler outages through the effective use of Betz *Specialized* Water Conditioning Service. Why not call on Betz today for an interesting discussion of your water problems? There's no obligation, of course. W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa. In Canada: Betz Laboratories Limited, Montreal 1.

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Other factors which must be considered in modern piping design are described below.

Superheater Headers

Whether it is cheaper to have a rigid steam line and flexible header connections, or a steam line which is free to expand and rigid header connections, will depend on the design of each system, and the estimated costs for each should be compared. In a recent plant, $25,000 was saved by using a steam line which was free to expand and rigid superheater connections, while for the same boiler it was cheaper to have a reheat outlet header which could follow the movement of piping and to make no separate provision for expansion of the main steam line. When designing these headers, it must be remembered maximum stresses occur at end points, so terminal connections demand as much attention as vertical and horizontal runs of pipe.

Metallurgy of Piping

A designer should know how high pressures and temperatures affect the strength of piping. He should know that graphitization starts in medium-carbon steel at 800 to 875 F and in carbon-0.5 per cent molybdenum steel at 900 to 975 F, usually after about 40,000 hours operation; that high aluminum content deoxidized steel graphitizes more than low aluminum deoxidized steel; that 1 to 2 per cent of chromium added to steel prevents graphitization; that carbon steel pipe should not be used above 775 F, and carbon-0.5 per cent molybdenum steel not above 875 F. From 875 F to 975 F, 1 per cent chromium-0.5 per cent molybdenum is used; from 975 F to 1050 F, 2 to 3 per cent chromium and 1 per cent molybdenum steel alloy is practical.

Welded Joints

High pressure piping is made by boring forged steel billets and finishing on a lathe. The size and shape of pipe a firm can make depends on the material they have to work with and their manufacturing processes. Before deciding the position of welded joints the designer should consult the piping manufacturer to make sure it is possible to make the length and shape of pipe he wants.

When deciding where to use welded joints, the designer must be guided by the code as well as the cost of these joints. For high pressure temperature joints the material and labor costs are formidable. By the time the metal has had ultrasonic tests to detect laminations which might cause weld defects; magnetic particle tests; stress relieving heat treatment; gamma ray inspections, etc. the actual welding operation is quite a small part of the total cost. Today, a 14-in. pipe weld takes 238 man-hours; a 10-in. pipe 140 man-hours.

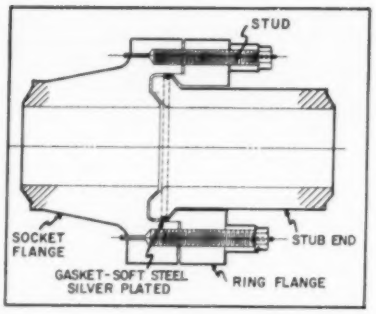


Fig. 3. Cross-section through a pressure-seal joint

As little welding as possible should be done in the field; shop welds are better and cheaper than field welds.

Pressure Seal Joints

Pressure-seal joints are proving very satisfactory for high pressure temperature piping. A section through one of these joints is shown in Fig. 3. Above 1200 psi and about 925 F, ordinary flanged joints often leak with rapid changes of temperature. Pressure-seal joints do not leak at these pressures and temperatures because they use the steam pressure for sealing, so the greater the pressure the better the seal. They do have a tendency to leak after changes from high to low pressure, due to movement of the sealing surfaces, but this is easily stopped by tightening the studs.

LETTERS TO THE EDITORS

Boom Intake

(*Continued from page 57*)

HEREWITH some random comments on the intake screen arrangement of George Rodemeyer, page 62, February issue. These comments are by two of the engineers in this branch and myself.

a. *Initial cost and method of installation*
   1. Our organization does not house the equipment above the deck level. This eliminates in part the advantage mentioned by Mr. Rodemeyer.
   2. We use a single gantry crane to service pumps, motors, screens, stop logs, and large valving equipment. We consider this service worth many times what it costs in substructure installation.

b. *Screening effectiveness*
   1. Do not like omission of trashrack. Believe damage to screen possible by logs, etc.

c. *Ease of operation*
   1. Operation seems more clumsy than vertical screen. Power to operate should be more because of the large angle of application.

d. *Methods and cost of maintenance, cleaning, etc.*
   1. We have found it necessary to remove material which becomes embedded in the screen and cannot be washed out by the high pressure sprays. This is done by hand on the downstream side and would be very difficult with the new design.
   2. Repairs to underwater parts would be very expensive without an upstream closure.
   3. Logs and trash under screen at bottom could interfere with operation of rotating parts.
   4. After high water a big job of cleaning trash from behind screen will be required. Also possibility of extensive repairs.
   5. During high water spray nozzles are submerged and plugging not observable or repairable, thus permitting trash entering pump suction.
   6. Too much mechanical equipment submerged in water. How repaired? Diver? New cofferdam?

The above should not be construed as indicating that there is no merit in Mr. Rodemeyer's design. I believe the chief advantage is its probable lower cost. Whether this saving is gained at the expense of higher maintenance and cleaning costs is something that only experience can tell. Until such is proven we should hesitate to supersede our design, shown on attached print. This design might be called a compromise design in that it eliminates part of the superstructure without losing the proved operating advantages of an accessible screen.

However, Mr. Rodemeyer should be given credit for a novel design and for trying to improve what admittedly is not, at the present time, a perfect working arrangement. It is in that way that the art of engineering design is constantly being improved.

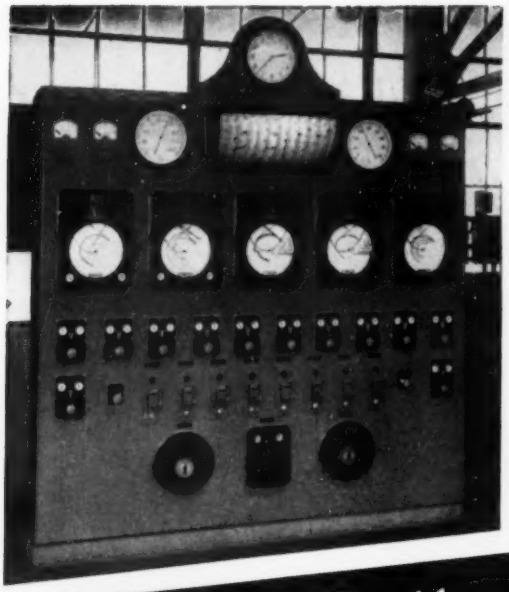
Tennessee — POWER ENGINEER D

GEORGE RODEMEYER'S new boom intake represents original thinking of an inventive nature and I believe offers in general the advantages claimed.

It seems to me the one disadvantage is lack of accessibility of the mechanism for cleaning and repairs, as there appears no way of freeing the water from the boom interior for such purpose.

The design shown in Figure 2D is the simplest and cheapest. If this were made in multiple units with one in reserve, with the added feature of a hoist designed to remove and replace any unit as required, would it not perhaps be the best solution?

New York — POWER ENGINEER F



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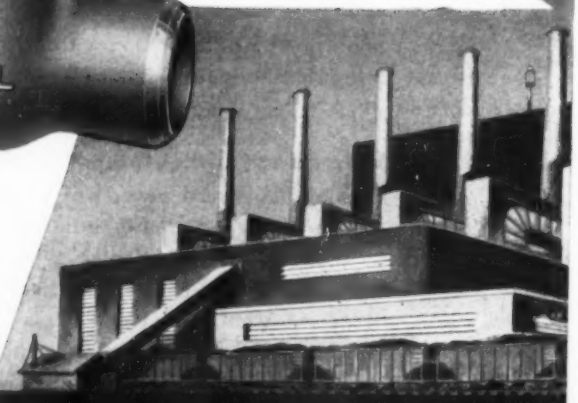

POWELL

BRONZE, IRON, STEEL AND CORROSION-RESISTING VALVES

For more data circle 541 on Post Card

Operating Experience with Hydro-Plant Valves

By **WILLIAM G. WEBER**

Engineer Design and Construction Division
Bureau of Reclamation
Denver, Colorado

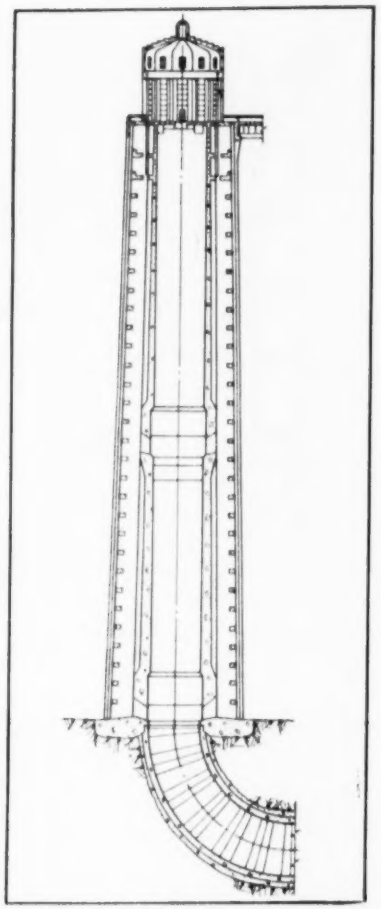

Fig. 1. One of the 4 intake towers at Hoover Dam. Ports are 184 and 334 ft below the water

Pitting, vibration and leakage are three major problems faced by the Bureau of Reclamation in operation of large cylinder gates and butterfly valves. These specific examples show what has been done

THIS ARTICLE discusses performance of cylinder gates and butterfly valves installed at several Bureau of Reclamation dams and power plants.*

Unlike the cut-off type of gate, gates of the cylindrical type do not ride on seats on which friction is proportional to the unbalanced head; rather, load is carried by compressive or tensile stresses in the cylinders.

Cylindrical type of gate is exemplified by the two 32-ft diam by 11-ft travel cylinder gates in each of four penstock intake towers at Hoover Dam. One of the intake ports in each tower is 184 ft below maximum water surface; the other intake port is 334 ft below maximum water surface. Figure 1 shows one of the towers and the two sets of intake ports. The tower serves four 115,000-hp generating units and delivers a maximum of about 7,520 cfs of water for power purposes through a 30-ft diam penstock. Each gate is raised or lowered by means of three stems connected to motor-driven screw hoists located in the hoist chamber at the top of the tower. Stems for the two gates in the tower are concentric — stems for the lower gate being encased by and traveling within stems for the upper gate above the elevation of the upper intake port.

Hoover cylinder gates are used for shut-off service only, and have never been closed under an unbalanced head emergency condition. The gates were carefully made and seats accurately finished. However, seating surface around the circumference of a gate is about 100 ft long, and it is almost impossible to make a uniformly tight, metal-to-metal seal in that length. Also, intake ends of the penstocks were suspended from the seat castings when installed, and it is believed that as a result castings were slightly warped. Although efforts were made on installation to hand grind the seats to uniform contact, there has been an appreciable leakage past cylinder gates when closed.

Gates At Cle Elum Dam

A similar but smaller set of cylinder gates is installed at Cle Elum Dam and serves to regulate releases through the outlet works. As at Hoover Dam, there are two screw-hoist-operated gates in tandem in the gate tower. Each gate is about 18 ft 8 in. in diam and has a 6-ft 3-in. vertical travel. Normally the head of water on a gate is not more than 100 ft.

Both Cle Elum gates have caused trouble since construction of the dam in 1933, and damage to stems, seals, bottom angles, and guide parts has resulted. Damage to the lower gate has been repeated and particularly severe. It appears to have been caused by heavy vibrations and impact set up as water is discharged through the gate, rather than by overloading of the parts. It has been noted at various times that vibration was most severe when the gate was from 12 to 15 in. open. Studies indicated that unstable pressure conditions could exist under the lower edge of the gate within the given range of opening and thus could be a major cause of gate vibration. To correct this instability a structural angle was curved to shape and attached to the bottom of the lower gate during the winter of 1949–50, as shown in Fig. 2. Since this alteration was made, according to available information, releases through this gate have been materially quieter than before.

Each of the two Cle Elum cylinder gates discharges through 6 ports into a central circular well. Walls and beveled lips of the upper gate ports are unlined concrete and have slowly been pitted to a moderate extent. Ports for the lower gate were originally the same as for the upper one, but pitting was more rapid and they were lined with steel plates some years ago. Pitting has continued since that time on the discharge side of the shaft below the ports. As shown in Fig. 3, reinforcing steel has been plucked free all around in area between port lips. A ½-in. plate was placed in front of the exposed steel and welded to it; space behind was filled with grout. More time must elapse before it can be stated that pitting has been stopped.

Butterfly Valves

Butterfly valves in service on reclamation projects are almost all intended for shut-off and emergency

* This is the third of three articles adapted and abstracted by the author from his paper on the same subject before the National Conference on Industrial Hydraulics at Chicago in 1950. First article on cut-off type gates appeared in the October, 1952, issue, page 110. Second article, on cylindrical or axial-travel type gates and valves, appeared in the March, 1953, issue, page 84.

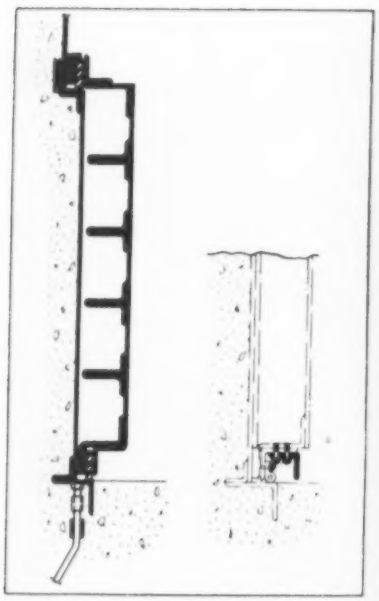

Fig. 2. To stop lower gate vibration (left) a structural angle was added to gate bottom (right)

Fig. 3. Reinforcing steel has been plucked free near the port of this lower cylinder gate at Cle Elum

closure only. For shut-off service the operating conditions are not severe as the turbine wicket gates, or the regulating gates downstream, are first closed and no unbalanced pressures develop on the face of a valve leaf until after it is closed. Leakage in most instances is minor and easily absorbed by pumps or drain lines. This has not been entirely true of the 132-in. butterfly valves installed for guard or emergency shut-off service in the outlet works at Cle Elum Dam.

These butterfly valves have been in service since completion of the dam. Their service has, in general, been satisfactory, but in recent years they have been leaking in increasing amounts. In 1948, it became almost impossible to unwater the gooseneck in the outlet conduit using the available pumps — amount of water escaping by both valves totaled about 4 cfs. Principal leaks were at the seals on the edges of the leaves that are downstream when the valves are open; that is, the edges that have to be held shut by the operating mechanism against reservoir pressure. Although the seals are adjustable, they had become badly worn. As their adjustment was no longer effective, they were in need of either replacement or repairs. The intake tunnel was accordingly bulkheaded off and the outlet drained. As is sometimes the case when repairs of this nature are needed, the preliminary preparations were more troublesome and costly than the actual work on the valves. A period of low reservoir level and no irrigation requirements was selected. A floating bulkhead was constructed, towed to position over the intake structure, lowered into place with the aid of divers, and then braced from the interior of the tunnel to supplement the guide slots. Damaged seals were then repaired in place by bronze welding of the worn or eroded surfaces and ground to the correct contour. When water was again admitted to the tunnel the leakage was found to have been greatly diminished.

Most butterfly valves are hydraulically operated. Those at Hoover Dam, 120 in. and 168 in. in diam, rotate on vertical shafts and are driven by hydraulic rotors mounted on the upper shaft extensions. Commonly, valve leaves rotate on horizontal shafts and are driven by pistons of hydraulic cylinders, in which oil is used as hydraulic fluid in all instances.

There are few butterfly valves in use for free discharge. Except for a 48-in. valve at Cascade Dam and two 54-in. valves at Roosevelt Dam, these valves are in low-head service, though more high-head valves are planned. Roosevelt valves when used are run wide open and not for regulation at part openings. They have seldom been opened in recent years but have reportedly given satisfactory service.

The valve at Cascade Dam is used to release 200 cfs of water to a stilling box at the intake of the penstock of a private power plant. As the normal reservoir head of about 75 ft is more than sufficient to force the required amount of water through the fully opened valve, the latter is maintained in a partly opened position. The valve has been in service for about $2\frac{1}{2}$ years. It is rather noisy and vibrates to a noticeable degree. Recently, however, when it was taken out of service and inspected, almost no pitting due to cavitation was found — there was little damage other than paint removed from the pipe in a narrow band adjacent to the valve.

You Can Build on Sand

The old Biblical admonition, to build your house upon a rock and not upon sand, no longer is true as applied to construction methods. A large chemical plant containing heavy structures is being built on dry wasteland sand in Florida, according to *The Ohmite News*. The sand on which the foundation is built is compacted by a vibroflotation process, which increases the relative density of the sand through a shaking and pushing process that packs the sand grains more closely. The vibrating device consists of a tube vibrated by an electrically-driven eccentric inside it. This vibrator is lowered into the sand while a water jet at the tip saturates the sand. Fresh sand is shoveled in from above to fill the space produced by the compaction.

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7. Simple locking of disc and disc nut.
8. Self-compensating yoke protects seat and disc against wire drawing, leaks and damage.
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11. Packing inhibited against stem pitting.
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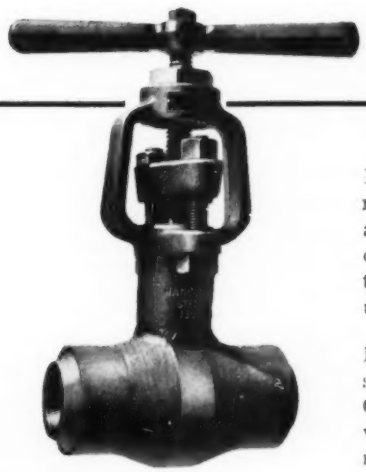
13. Uniform packing gland load.
14. Alloy steel packing studs—stronger, better.
15. More than adequate stuffing box depth.
16. Corrosion-resisting back seat.
17. No left-hand threads.
18. Simple thread bushing locking.
19. Proved 1500# and 2500# ratings at 1050°F.
20. Design proved in high-temperature valve research and applications since 1935.
21. Meet A.S.M.E. blow-off requirements without special installation.
22. No excess weight to create piping strains.
23. Compactness that saves space.
24. Valve stays in the line for servicing.



High-pressure, high-temperature steam plants must have the safest, most dependable shut-off valves obtainable. That is why Hancock 1500# and 2500# Weldvalves are preferred by the majority of design and operating engineers in such plants. They know from long experience that these rugged valves end the costly hazards of valve leakage—stand up in the severest service.

Hancock 1500# and 2500# Steel Weldvalves are made in ¼" through 2" sizes inclusive. Service rating is up to 2500# W.S.P.—1050°F., and 6000# O. W. G.—100°F. Whatever your needs, remember only Hancock Weldvalves have *all* the design, quality and construction features essential to reliable leak-proof performance. So—protect your personnel, plant and service to customers—install safe Hancock Weldvalves.

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How to make packings last longer

Tips by Johns-Manville Engineers to help you keep production rolling

Keep equipment in repair for best packing service

Worn shafts wear me down

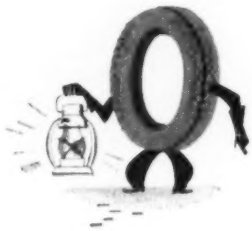
Trying to make packing compensate for excessive shaft or rod wear will shorten packing life materially without alleviating the undesirable condition. Pack correctly to avoid excessive shaft and rod wear. Replace worn shafts and rods as soon as possible to avoid adding the expense of damaged packings to the cost of parts replacement.

"Bucking" shafts throw me!

Packings are for sealing only. Trying to compensate for shaft misalignment or vibration by overpacking and excessive gland pressure results in scored shafts and ruined packing. Think of a stuffing box as a potential brake assembly that may develop considerable frictional resistance with attendant heat and wear.

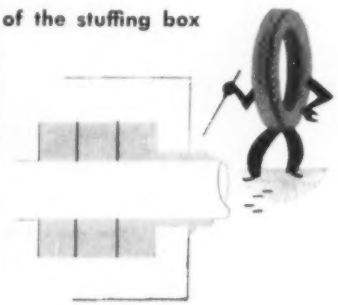
Keep my lantern clear

If the stuffing box is equipped with an oil, grease or water lantern, its purpose is defeated when the lantern ring is omitted or the opening blocked by improperly installed packing or other obstruction. This can deprive the packing of lubrication or cooling and result in premature failure.



Don't let me get out of the stuffing box

If the shaft or rod is badly worn, the packing may be extruded into the system when the gland follower is taken up. Considerable difficulty such as packing getting into valves or traps or contaminating the fluid handled may result. Rebush the stuffing box or use a junk ring to reduce the clearance.



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Corrosion of piping in steam and condensate return lines is an expensive two-way headache. (1) It leads to large outlays for pipe replacement and maintenance. (2) It often results in plugged return lines and traps due to the solid products of corrosion. Bird-Archer Amine Treatment effectively eliminates these troubles at low cost.

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Stress Corrosion and Season Cracking in Condenser and Heat Exchanger Tubes

PART 1

Condenser and heat exchanger tubes made in accordance with A.S.T.M. Specification B 111 are generally supplied in the annealed condition with a medium to fine grain size. If properly handled, they are free from internal stresses. However, if they are subjected to applied stresses produced by high operating pressures or restraint of thermal expansion and contraction, or to residual stresses such as developed by overrolling, flattening, bending, denting, and rough handling, they may fail from either stress corrosion or season cracking when exposed to certain corrosive environments.

Factors Producing Stress Corrosion Cracks

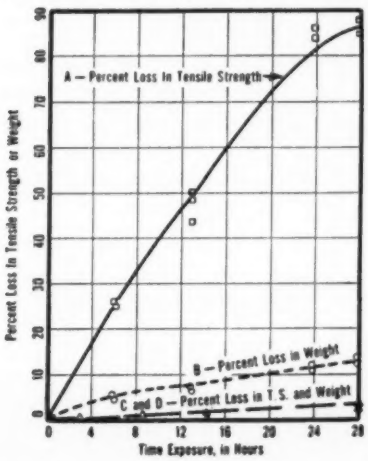
Season cracking or stress corrosion of copper-base alloys depends upon the following factors:

(1) Composition of the atmosphere or liquid surrounding the stressed metal (ammonia, mercury and mercury salts are the biggest offenders).

(2) Composition of the alloy.

(3) Magnitude of the stresses.

Effect of Internal Stress on Corrosion of Yellow Brass (A and B) and 70-30 Cupro Nickel (C and D) Tubes in Concentrated Ammonium Hydroxide Vapors at 250°C.



The combined action of at least three substances: ammonia or ammonia-producing material (organic and inorganic substances containing nitrogen), water and oxygen usually are necessary to produce stress corrosion cracks in copper-base alloys. These three substances may be found where condensation of moisture from a gas, air or steam forms on the cool tube surfaces.

Oxygen and traces of ammonia from various sources may dissolve in the water film. The corrosion products which form under these conditions frequently are dark blue, black or dark brown with only a small amount of metal being corroded. Failure may develop within a few hours or after several years depending upon the magnitude of the stresses and the corrosive medium.

Influence of Alloy Composition

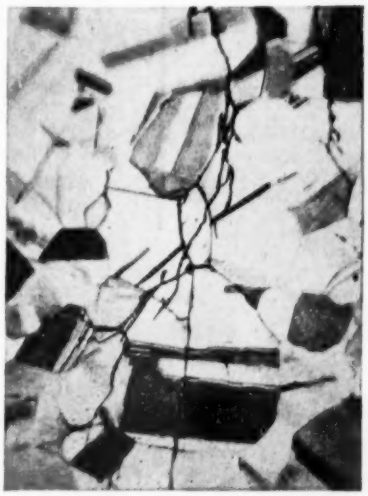
The resistance to season cracking and stress-corrosion cracking of copper-base alloys is influenced by their compositions. Briefly, alloys with higher copper content resist cracking better than low copper alloys. A simple procedure which graphically shows this difference in resistance to season cracking consists of plotting the per cent loss in weight and the loss in tensile strength of corrosion test specimens against time of exposure to ammonia solution.

Typical curves for yellow brass (A and B) and 70-30 Cupro Nickel (C and D) are shown. The spread between the curves A and B, showing the per cent loss in tensile strength and weight, reveals the presence and intensity of season cracking. When no residual stress is present in brass, the tensile loss curve A becomes identical to the weight loss curve B, indicating that no cracking has occurred.

Curves C and D for highly stressed 70-30 Cupro Nickel show that the curves for loss in weight and for loss in tensile strength are identical, indicating freedom from stress corrosion cracking under these conditions.

Laboratory Assistance Available

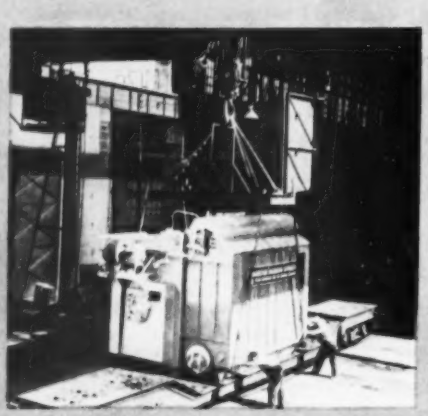
Bridgeport's Corrosion Laboratory will welcome an opportunity to help you with any condenser or heat exchanger tube problem. (9774)



Cracks resulting from stress corrosion in Admiralty metal. Mag. 500X.

For more data circle 545 on Post Card

4 reasons why... the V P Package



1 **Fully Water-Cooled Furnace** – More cooling area per cubic foot of furnace volume than any other boiler of the VP's size and type. In all but the three smallest sizes, the VP Boiler has water-cooled walls on ***all six sides*** – including the burner wall.

2 **Larger Lower Drum** – The 30 in. diameter lower drum permits a simple, symmetrical tube arrangement . . . provides easy access for washing down or inspection . . . its greater water storage capacity facilitates the handling of fluctuating loads.

3 **Centrifugal Fan** – This more efficient type of fan operates at lower speed than other types and is quiet in operation. In fact, its average noise level is less than half that of typical high-speed blowers used on most package boilers.

4 **Simple Baffle Arrangement** – Minimum changes in direction – no baffle at all in convection bank in larger VP Boilers. This means lower draft loss . . . simplified soot blowing . . . elimination of dead pockets, thus, maximum heat pick-up. In the intermediate sizes, a water-cooled baffle assures minimum maintenance.

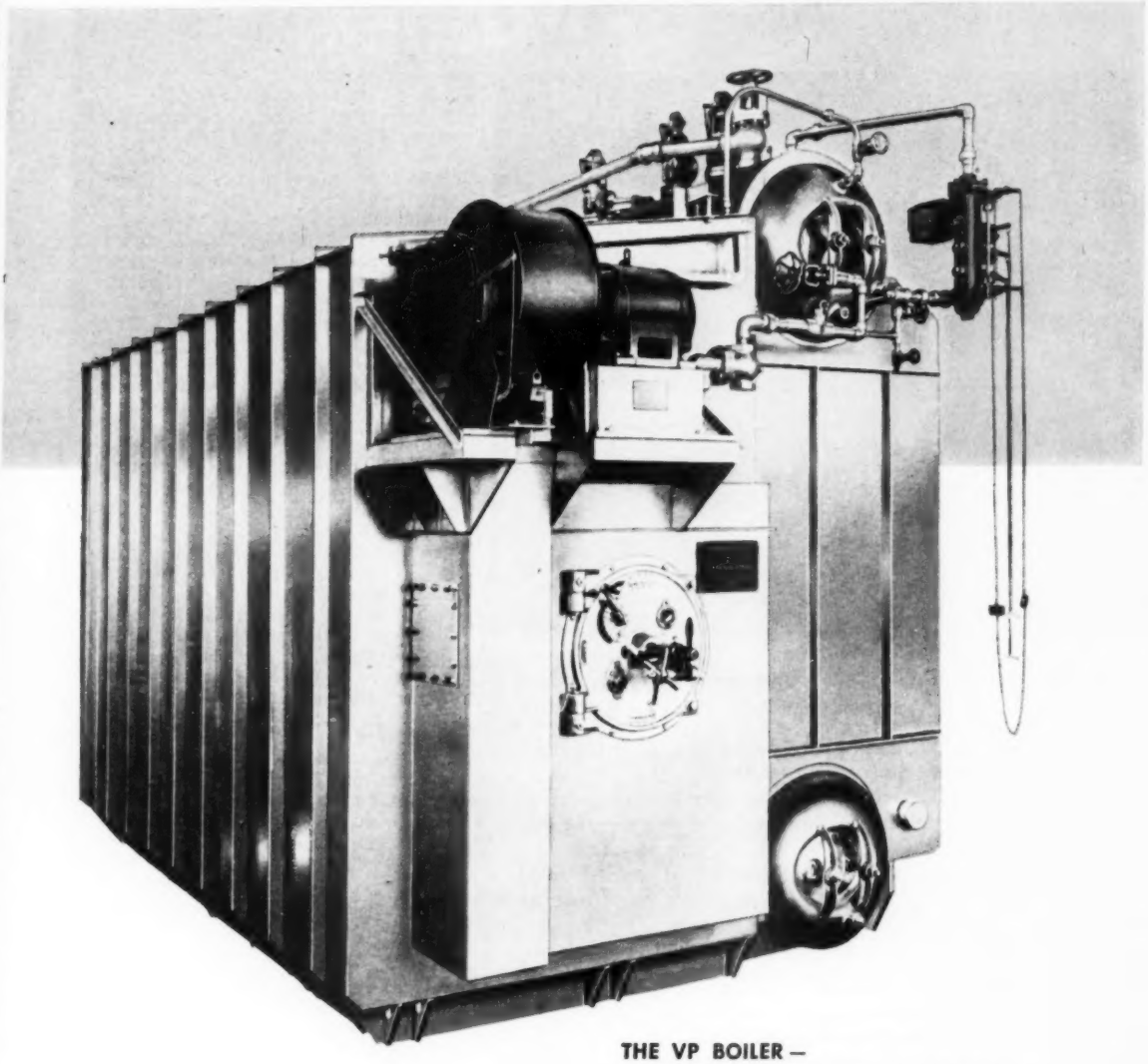
• • •

These four *extra* features are yours *only* in the VP Boiler which is designed and manufactured by Combustion – maker of many of the world's largest boilers. These units are available in capacities ranging from 4,000 to 30,000 lb of steam per hr, and pressures up to 250 psi.

Complete details on the C-E Package Boiler, Type VP, are available to you. Send for your free copy of Bulletin VP-111.

COMBUSTION

is Your Best Boiler Buy



THE VP BOILER—
the Package Boiler with *extra* features.

B-666

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ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

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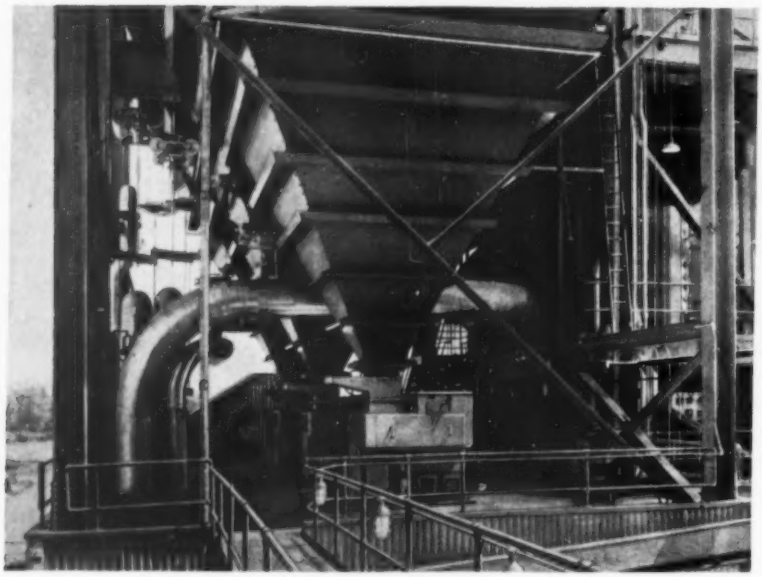
Carolina Power & Light

again specifies

Richardson

Richardson Automatic Coal Scales are playing a vital part in helping supply power for the new Industrial South. Here are Richardson Model 39's in an outdoor installation at the new generating station of Carolina Power and Light.



To both industrial and utility power generating stations, specifying Richardson means—

1. A 24" x 24" inlet opening and 26" wide belt for maximum coal flowability.
2. All wiring and controls outside coal chamber.
3. Access doors which will not spill dust on floor when opened.
4. Beam ratio test facilities outside coal chamber.
5. Gravity operated by-pass, with no restriction of coal flow to downspout.
6. No drag links or wires attached to weigh hopper.
7. Nationwide after-delivery service.

Latest development in the 39 Series of Richardson Automatic Coal Scales is the Model H-39 shown below. May we send you our new 16-page engineering data book on the H-39 Coal Scale (Bulletin 0352), without cost or obligation?

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Richardson

MATERIALS HANDLING BY WEIGHT SINCE 1902

For more data circle 547 on Post Card

AMERICAN POWER CONFERENCE

(*Continued from page 93*)

requirements of paper mills and showed how present-day power plants are built in those mills to meet these requirements.

Sal Gran, chief engineer of the California State Prison at San Quentin, reviewed the problems of a penal institution power plant, pointing out that custody of the prisoners is the important thing and, while some of them can be used in power plant operation, the selection of personnel is very important, for most of them must be trained on the job.

Engineering problems of a packing house were described by Lowell E. Joslin of Krey Packing Co. He reviewed the manner in which his company has set up its heat balance for steam, refrigeration, and other power services for a factory that is fairly concentrated and how they worked out their steam supply by installing an extraction type turbine generator and raising the steam pressure.

In a state hospital, on the other hand, the distribution is quite spread out and Charles L. Bender, chief engineer of the St. Louis State Hospital, explained the problems of supplying steam and power to such an institution. His power plant includes engine generators and they have a combination a-c and d-c distribution system.

Maintenance of electronic equipment in large generating stations was discussed in detail by H. L. Garton of Commonwealth Edison Co. He discussed electronic boiler room control equipment, electronic instrumentation, and communication equipment, pointing out causes of failures in the circuits and giving suggestions on how they can be overcome and how proper maintenance can be carried out on this type of equipment.

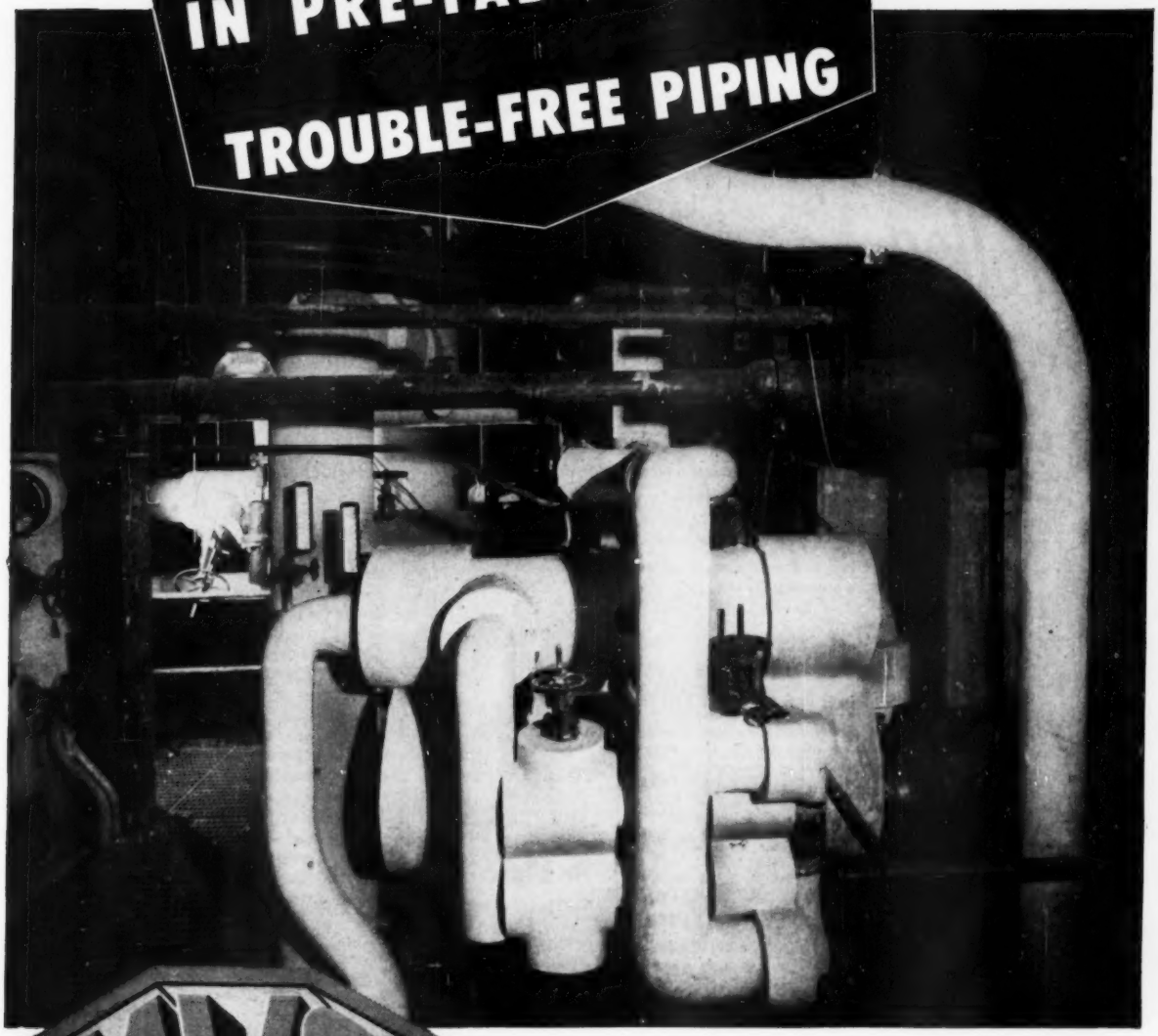
Conversion from one fuel to another was covered in two papers; one by George A. Pardee of Oertel Brewing Co. on conversion from coal to fuel oil at his plant. This was done at a cost of about $22,000 and, with oil, the operation is almost entirely automatic and in many cases, said Mr. Pardee, this conversion might save the cost of a boiler. Roger W. Jackson described how coke oven gas was used to replace coal in a Milwaukee Sewerage Commission plant and how greater efficiency and better working conditions resulted, although there was a very small increase in operating cost.

Operation of Large Units

Operating experience with large generating units was reviewed by Robert P. Liversidge of Philadelphia Electric Co., while Otto de Lorenzi of Combustion Engineering Superheater, Inc. reviewed 3,000,000-kw operating experience with modern reheat. Progress in design and appli-

(*Continued on page 110*)

NAVCO ACCURACY IN PRE-FABRICATION TROUBLE-FREE PIPING



Prefabrication accuracy is an essential "MUST" to assure a proper fit and economical operation. Navco's 40 years' experience in fabricating assemblies in all sizes and for all operating conditions is your assurance of such accuracy.

Consult Navco for your next piping job.

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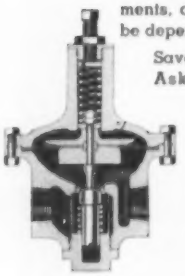
for efficient operation

Clark Pressure Reducing and Regulating Valves

are precision-made for positive pressure control on air, gas or steam lines.

Where different types of equipment, with varying pressure requirements, are operated from a common line, Clark Regulating Valves can be depended on to deliver automatically the "just right" pressure to each.

Save on fuel, maintenance and protect expensive equipment. Ask your Clark representative to specify the right Clark valves for your needs . . . or write us direct.

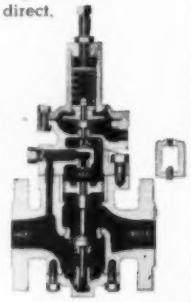


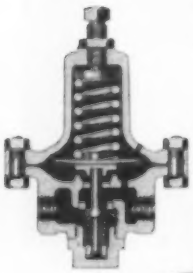
TYPE KRV

Pressure Reducing Valve. Diaphragm Operated-Single Seated Valve. Sizes ½" to 1½" for initial pressures up to 250 P.S.I. Reduced pressures to 85 P.S.I.

TYPE CRV

Pressure Reducing Valve. Integral pilot controlled, piston operated. For pressure control from "dead end" to full capacity. Sizes ½" to 6".





TYPE ORV

Pressure Reducing Valve. ⅜" and ½" Single Seated, Spring Loaded, Diaphragm Actuated. For initial pressures to 250 P.S.I. Reduced pressures to 200 P.S.I.

QUICK-CLEANING STRAINERS

Remove dirt, scale and grit from steam, fluid and gas lines. Sizes ½" to 3" I.P.S. For pressures to 250 P.S.I.

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AMERICAN POWER CONFERENCE

(Continued from page 108)

cation of large steam turbine driven generators was discussed by C. E. Kilbourne and J. H. McClure of General Electric Co., who showed the latest designs in internal cooling of generators with both gas and liquid. This subject was also covered in papers by J. W. Batchelor of Westinghouse and William L. Ringland and L. T. Rosenberg of Allis-Chalmers and these papers were discussed in considerable detail by Carl Fechheimer, who has been working on liquid cooling of generators for many years.

H. R. Reese of Westinghouse traced the development of the 3600-rpm turbine and concluded that if suitable materials are available, by 1963 a few turbines should be operating at 3000 psig and 1200 F. He expected that the 3600-rpm single-shaft machine will probably exceed 300,000-kw capacity, the double reheat cycle may be justified in many cases.

Carl Schabtach of General Electric Company reviewed factors influencing design and application of large steam turbines, calling attention to the gradual increase in pressures and temperatures and suggesting that it may be desirable to undertake a few installations of moderate size for these advanced steam conditions to obtain operating experience. Among other details, he stated that his company was revising its policy about the intercept valves on reheat turbines and beginning January 1, 1954 would equip all reheat turbines with a stop valve in the reheater circuit ahead of the intercept valves.

Francis L. Archibald and John W. Purssell, Jr., of Boston Edison Company, and Frederick G. Straub, of the University of Illinois, discussed prevention of metal losses in the wet steam areas of steam turbines.

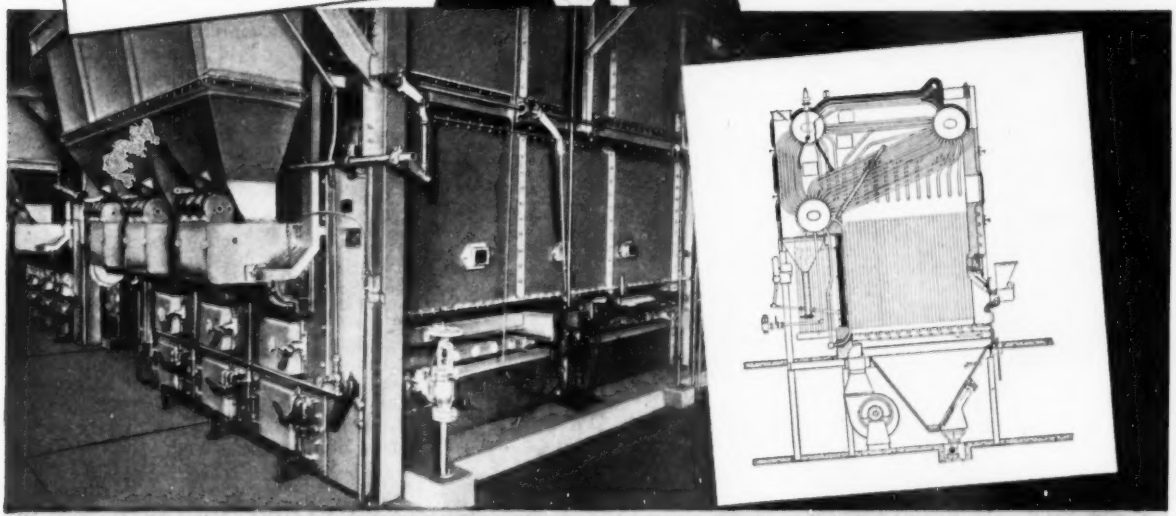
"We lit on a way to get him to keep an eye on his instruments . . ."

"WE SAVE OVER $68,000 A YEAR— BY BURNING COAL THE MODERN WAY!"

"New coal installation cuts fuel consumption 32%... labor costs 22%!"

says Mr. H. A. Sherer, Chief Engineer, Reeves Steel & Manufacturing Co., Dover, Ohio.

"We installed two new boilers and stokers and a modern coal- and ash-handling system. Here are our yearly savings: $38,576 saved on fuel, $9,353 on labor, $20,739 on repairs and maintenance. That's a total of $68,668—saved by burning *bituminous* coal the modern way!"



A view of the plant's firing aisle and a diagrammatic drawing of one of the boilers. It now costs 18.8¢ less to generate every thousand lbs. of steam. This is a saving large enough to amortize the entire installation in 3 years-3 months. And that includes all the cost incurred in tearing out old equipment and constructing a new plant floor!

Today, *bituminous* coal's inherent economy has been greatly increased. Modern combustion installations give you more steam for every dollar . . . automatic coal- and ash-handling systems cut labor costs to a minimum.

A consulting engineer can show you how coal can do a better job—*and save you real money*—in a plant designed to meet your *specific* needs.

In addition, with coal you get the basic advantages of price stability, and dependable supply. These advantages are assured by America's virtually inexhaustible coal reserves and the high productivity of America's coal industry.

If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest cost fuel.

COAL resources in America are adequate for all needs—*for hundreds of years to come.*

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

BITUMINOUS COAL INSTITUTE

A Department of National Coal Association, Washington, D. C.

FOR HIGH EFFICIENCY FOR LOW COST

YOU CAN COUNT ON COAL!

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Dart seats are wider and spherically ground to a true ball joint. You get a *drop-tight* joint without excessive wrenching. Yes, and you can use Darts over and over again to cut your costs!

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- 2 BRONZE SEATS resist pitting and corrosion — stay serviceable year after year
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- THREADS full, clean-cut and hard. They won't deform or strip

Be sure to say "Darts" to your supplier. They'll save you money and maintenance headaches over the years.

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DART UNIONS

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SAFETY TAGGING

(*Continued from page 61*)

energized, close the line grounding device and attach a Release Notice to its operating lever.

Returning to the control room, the operator will remove the Caution Order and attach the Release Order to the control switch. He then reports in detail all the operations which he performed, the dispatcher repeats the report and then the operator gives the approval phrase "That is right".

After receiving the reports of both operators, the Load Dispatcher will call the line foreman and inform him "Washington-Charleroi No. 1—132-kv line has visible openings at Washington and Charleroi, grounded at Washington and Charleroi and Release No. 758 placed for John Smith". Foreman repeats report and is given the approval phrase "That is right".

This being a double circuit the foreman is asked the following, as an additional check, "With your back to Washington, facing Charleroi, on which side will you be working"? After the dispatcher receives the correct answer, he then warns the foreman that the other line of the double circuit is energized.

Had a part-time or less experienced operator been on duty at one of the stations, the dispatcher would have given him an order detailing the switching steps instead of the "Place Release" order. In either case, the operator gives a detailed report of the switching performed.

Load Survey

NATIONWIDE survey to determine the fluctuation in home electric power consumption over a 24-hour period, with the cost to be shared by General Electric Co. and electric utilities, has been proposed by G.-E.

Clarence H. Linder, G-E vice president and general manager of the Major Appliance Division at Louisville, Ky., speaking at the 19th annual sales conference of the Edison Electric Institute in the Edgewater Beach Hotel, said such data, on a national basis, "are necessary for an effective load-planning effort" by the utilities.

"The General Electric Co., because of the importance of such a survey to the entire electrical industry, is willing to underwrite a substantial part of the total expenditure," he continued. "Indications are that the total expense will be so great and the benefits so widespread that we believe many in the utility industry will recognize the need and will want to join in underwriting the survey project."

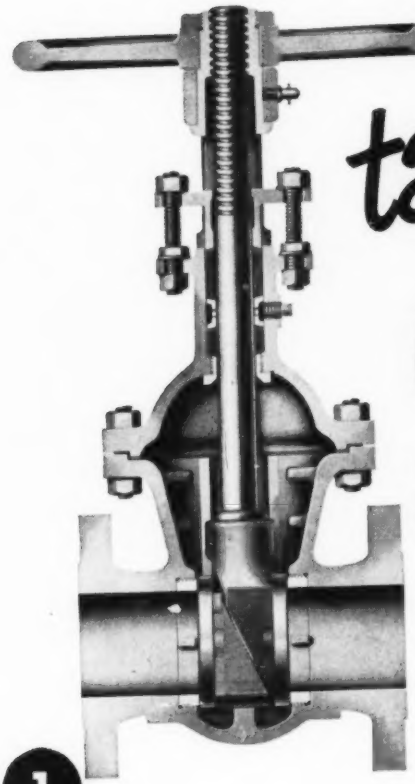
Linder said the company has engaged a consulting firm to study what information, methods, time and equipment will be needed for the survey.

PLUS VALUES, JOB-PROVED AGAIN AND AGAIN

DARLING VALVES

take your choice...

FOR BETTER, LOWER COST SERVICE WITH DARLING cast steel gate valves



1

2

DARLING VALVES FOR EVERY NEED

Darling gate valves are made in a wide range of sizes, types and constructions for all kinds of normal and unusual service . . . and for pressures up to 1500 pounds.

IN addition to gate valves of solid wedge design, Darling offers two other types. Both have distinctive features that prolong valve life while minimizing down time and maintenance. They're great time and money savers! . . .

1 This view shows a Darling gate valve of the fully revolving, double disc, parallel seat type. Time and again users rate it the most trouble-free, best performing gate valve obtainable today. Why? Because its unique design assures: *automatic* adjustment for valve body distortion . . . positive, easy operation . . . uniform wear distribution . . . foolproof simplicity in maintenance and reassembly . . . and service life seldom if ever equalled.

2 Take a close look at the slotted, double-grooved wedge in this cutaway view. There's little wear and tear on *these* wedge faces and seats because the slot permits compression of the wedge to compensate for valve body expansion or contraction due to temperature changes. Moreover, the double grooves, with twin guide ribs in the valve body, provide twice the usual bearing area, eliminating wedge canting and avoiding damage to the downstream seat.

SEND FOR BULLETIN

Why not get *all* the facts on these money-saving valves? Then *you* can analyze and decide whether or not you stand to gain by giving Darlings a try. Simply specify your service requirements . . . or ask for cast steel valve bulletin.

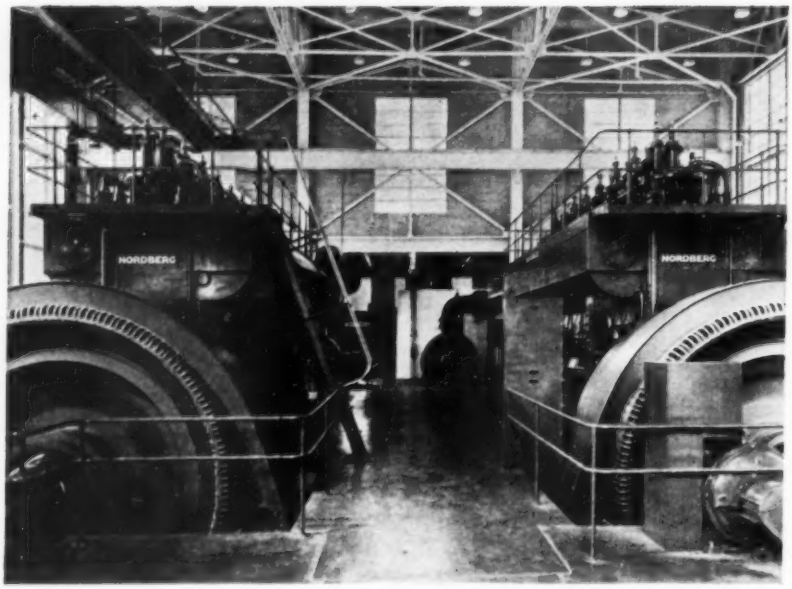
DARLING VALVE & MANUFACTURING CO.

Williamsport 19, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.

For more data circle 552 on Post Card

W. T. Elliott,
Power Plant Supt.,
says...



"We've Got Facts to Prove Rubilene's Superiority"

A lot of people depend on Mr. W. T. Elliott. For it's his job as Power Plant Supt. to see that the City of Denton, Texas has unfailing light and power 24 hours a day. To help live up to that responsibility, Mr. Elliott pampers his hard working Nordberg Duafuel® engines — makes sure they're lubricated with the finest oil available. He says, "We've been using Sinclair RUBILENE® since 1948 with *very satisfactory results*. Cylinder liner wear is only ⅓ of 0.001 inch per 1,000 hours running. Piston ring life is 16,000 hours of operation and we get 6,100 H.P. hours per gallon of oil... Facts like those have definitely sold me on RUBILENE."

Why not let the facts prove to you, too, RUBILENE is a superior lubricating oil. Phone your local Sinclair Representative or write to Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR DIESEL LUBRICANTS

save wear and replacements

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HELPFUL BULLETINS

(*Continued from page 38*)

perature instruments are explained along with recommended applications. Mounting dimensions included. Taylor Instrument Companies.

127 Data on Liquid Level Gages — Now available are nine data sheets covering company's line of liquid level gage valves for both tubular and flat gages; regular, offset and with union connections to gage. Complete specifications with illustrations showing cross sections, roughing dimensions and standard and optional connections are included. Jerguson Gage & Valve Co.

128 Saran-Lined Venturi Nozzle — Bulletin 130-J6 describes a flanged-type differential producer without piezometer rings, designed for corrosive liquids and slurry service. Tells uses of this nozzle, includes a list of liquids that can be metered with it. Includes ratio chart and capacity table. Builders-Providence, Inc.

129 For Indicating, Recording, Totalizing — Twenty-pp Bulletin 401 gives salient characteristics of company's new Type H meter for measurement of water, gas, air, sewage, sludge, other industrial liquors. This is a mercury flow type indicating, recording and totalizing unit which operates in conjunction with Venturi tubes, flow nozzles and orifice plates. Bulletin gives data on its operation, construction, sizes and capacities. Simplex Valve and Meter Co.

130 Dewpoint Measurement — Bulletin GEC-588A describes dewpoint measuring equipment for continuous accurate indication and recording of dewpoint temperature in a gas stream. Contains photos and diagrams of the indicator and recorder, tells applications and operating principles, and provides a chart showing relation between dewpoint and moisture content of gases. General Electric Co.

131 Steam Specialties — Catalog 53, 62 pp, describes a line of steam, gas, air, oil and water regulating equipment. Includes complete specifications, operational data and prices on pressure regulators, temperature regulators, combination pressure-temperature instruments, diaphragm valves, motor operated valves, float valves, safety and relief valves, strainers, solenoid and motor valves, water gages. Provides capacity tables, flange charts, and steam pressure tables. O. C. Keckley Co.

HEAT EXCHANGE EQUIPMENT

132 Air-Cooled Heat Exchangers — Twelve-pp illustrated Bulletin FF-FD-0.001 covers air-cooled heat exchangers for a variety of industrial cooling and densing applications. Units described are forced draft type and designed to cool liquids or gases at pressures to 5000 psi and temperatures to 1500 F. These air-cooled units are being installed to replace or augment water-cooled heat-exchangers in many plants faced with the need of dissipating great heat loads from everyday processes. Fluor Corp., Ltd.

133 Condenser Tube Inserts — Illustrated Bulletin 500 describes condenser tube inserts which help to put tubes of boiler heat exchange equipment back into operation quickly. Explains that the tubes usually fail in the first few inches of the inlet, and that these inserts restore leaking tubes by sealing off the deteriorated portion, also retarding or eliminating effect of inlet end erosion. Thomas C. Wilson, Inc.

OTHER EQUIPMENT

134 Steam Accumulator — How the steam supply and demand can be balanced by means of company's steam accumulator is told in Bulletin RA-52-8. Stresses reduced boiler capacity required and increased boiler efficiency afforded by use of the accumulator, other advantages. Discusses operating principle, tells how to calculate accumulator capacity, diagrams an installation. Foster Wheeler Corp.

135 Water Conditioning Equipment — Twenty-pp Bulletin 611A presents many forms of water conditioning equipment and materials which, singly or in combination, meet practically every water conditioning requirement. Includes descriptive and application information and special features of softeners, ion exchange resins, boiler and process water conditioning systems, filters and purifiers, degasitors, water treating chemicals. Fully illustrated. Elgin Softener Corp.

136 Regenerative Fly Ash Collection — This 6-pp folder describes a fly ash collector which consumes no power, has no moving parts and is designed for high efficiency and wide adaptability. Explains how this collector works to remove fly ash, soot and cinders from boiler flue gas by centrifugal separation, operating from the natural draft of the stack itself. Breslove Separator Co.

137 Air for Combustion Equipment — Catalog K-100, 8 pp, describes centrifugal pressure blowers designed to deliver air at constant pressure, regardless of load, to provide a non-pulsating air supply for efficient combustion of gas or oil fuels. Presents pulley drive, double bearing, single inlet, and V-belt drive types, includes dimensions and specifications. Eclipse Fuel Engineering Co.

138 Treatise on Diesel Cooling Water — "Water Side Deterioration of Diesel Engine Cylinder Liners" is an 8-pp discussion of the problems in water cooling of diesel engines, especially a "dynamic" pitting. Reasons are given for failure of protective measures to stand up in service and remedies are suggested. The International Nickel Co., Inc.

139 Versatile Winch Hoists — Some of the many uses for lightweight hoists of 750- to 1500-lb capacities are detailed in Bulletin 116. Discusses safety features, construction, easy maintenance; provides specifications. Pictures accessories. The Lug-All Co.

140 Burner Tips and Heads — Bulletin 526 gives details and specifications on company's standard gas burner tips. Describes in detail a special order service in making burner tips and heads to any design. American Lava Corp.

141 Condensation Control Charts — This folder contains charts showing degree of protection from condensation afforded by company's Type D insulation, a spray applied cork and Gilsonite mastic coating. Charts show how much the surface temperature will be raised after application of the insulation, also percent of relative humidity above which condensation forms on bare surface at various temperatures. Insul-Mastic Corp. of America.

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Catalog Library

THIS MONTHLY list of standard catalogs and bulletins is published to help power engineers maintain a permanent catalog file of engineering data. The items listed, unlike those under Helpful Bulletins, may appear each month except for additions and deletions determined by space requirements or by the manufacturers issuing the catalogs and bulletins. Use the postage-free card below for your request

ELECTRICAL

201 Electrical Maintenance Tips — Booklet B-5477, 28 pp, gives a complete outline of preventive electrical maintenance. Discusses general maintenance programs designed to reduce shutdown time and treats in detail the maintenance of power equipment. A suggested schedule of work and cleaning on power equipment is presented in chart form. Essential information on preventive maintenance for turbines, generators, switchboards, motors and controls is provided. Westinghouse Electric Corp.

202 Wire, Cable Ordering Guide — Newly-released General Catalog W-52-3, 186 pp, presents more than 500 different types of wires and cables. Contains comprehensive data on construction and operating characteristics for control and signal cables, cables for construction work, telephone wire and cables, and portable cords. A technical engineering data section is included. United States Rubber Co.

203 Power Distribution Practices — The 28-pp "Individual Power Distribution Idea Book" (Bulletin GEA,5900) is a guide on electric power distribution practices in large and small plants. Covers utility distribution practices; methods of buying electric power; what to do when a choice of primary voltages is available; application of primary switches and circuit breakers; types and arrangements of primary cables; and types of load-center distribution systems. General Electric Co.

INSTRUMENTS AND CONTROLS

204 Supervisory Instruments — Catalog 90-2, "Supervisory Instruments for Power Generation," consists of 41 pp on the instrumentation involved in generating stations. Separate sections cover steam generation instrumentation, turbine and generator instrumentation, electrical distribution instrumentation and diesel engine instrumentation. Measurement of temperature, pressure, flow, power generation and other variables discussed. Brown Instruments Div., Minneapolis-Honeywell Regulator Co.

205 For Practical Men — This 24-pp pocket-size booklet presents insulation testing in simple language. Packed with maintenance hints, explains electrical insulation, tells how it can be tested and what makes it go bad. It describes the Megger insulation tester, justifies cost in long run economy. James G. Biddle Co.

206 Industrial Thermometers — Catalog 125, 28 pp, presents ordering data on a wide range of industrial thermometers, giving scale ranges, dimensions and prices. Features company's Adjust-Angle thermometer designed for use at any angle front to back, left or right, through a 180 deg arc. Gives construction details and advantages of this adjustable-stem type instrument. Weksler Thermometer Corp.

207 Easy Reading Gage — An all-hydrostatic remote reading gage for boiler water and other liquid levels is described in Catalog 500, Section CO. Pictures improved visibility, other advantages offered by this gage, explains operation. The Reliance Gauge Column Co.

208 Sight Glass Flow Indicators — Twelve-pp Bulletin 18-W, on company's line of flow indicators, shows how these mechanical devices indicate fluid flow and its direction in pipelines which can be directly observed through a sight glass and are suitable for service with liquid, gas, vapor, slurry or sludge sufficiently translucent to permit observation of indicating element. Schutte and Koerting Co.

209 Pressure Regulator — Bulletin 1-B, 8-pp discusses design, operation and applications of a super-sensitive pressure regulator; shows typical installations. Also covers a compound regulator for back pressure relief valve. Atlas Valve Co.

210 For Feedwater Analysis — Bulletin 148 BP contains a technical discussion of manufacturer's analyzers for determination of dissolved oxygen and hydrogen in feedwater. Discusses both O_2 and H units as to function, ranges, accuracy. Cambridge Instrument Co., Inc.

211 Electronic Control System — Bulletin A-701 introduces company's Autronic system, a miniature all-electronic system for controlling pressure, temperature, flow and level, intended for use in chemical processing plants, refineries, central stations, other applications where fast, accurate control is required. The Swartwout Co.

212 Instruments Control Systems — Twelve-pp Catalog 513 presents manufacturer's line of instruments, control systems, regulating valves and desuperheaters. Covers draft and pressure instruments, boiler meters, recorders, thermometers, regulators, combustion controls, pump controls and many others. Republic Flow Meters Co.

213 Boiler Control — Ten-pp Bulletin 1007 describes a completely integrated system for controlling combustion, feed water, boiler steam temperature and boiler cleaning, available in a single package or furnished separately. Illustrated with full color drawing of complete control, photos of recorders, drive unit. Covers instrumentation with both miniature and standard instruments. Copes-Vulcan Div., Continental Foundry & Machine Co.

214 Panel Planning Ideas — The engineering and economical planning of modern combustion and process control panels is discussed in 8-pp Bulletin 170. Numerous panel designs, fashioned for control, are illustrated along with the most up-to-date methods of tubing and wiring. A section on accessories helps make this a

(*Continued on page 131*)

MAY, 1953

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POWER ENGINEERING

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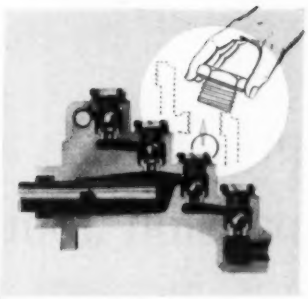
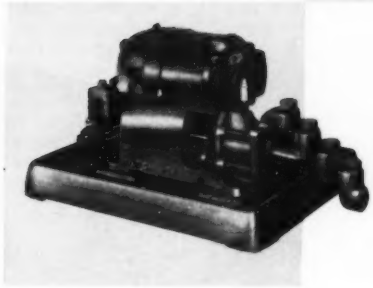


Basic design simplicity of the *exclusive* Milton Roy liquid end step-valve assures high and reproducible volumetric efficiency. Inspection, servicing, or thorough cleaning of individual ball-checks and seats are effected without disturbing piping or other ball-checks and seats.



Two-to-One Service Life with this Milton Roy Pump

CONTROLLED VOLUME PUMPING

INSTRUMENTATION

PROCESS CONTROL SYSTEMS

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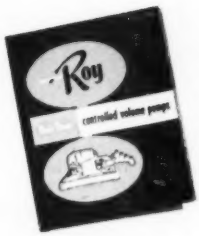
ON THE JOB for a leading chemical manufacturer, this Milton Roy Motor-Driven Controlled Volume Pump is still going strong after 4½ years of operation . . . has needed very little maintenance. A previously employed chemical feed pump, on the other hand, lasted only 2½ years, and required considerable maintenance.

Long service life is just one of many reasons why rugged Milton Roy Pumps are in wide use throughout industry. Wherever requirements call for precise metering of measured quantities of liquid in controlled volume, there's one of these versatile instruments to do the job. Capacity of each pump is variable from 0 to 100% by any one of several mechanical or automatic means of plunger stroke or speed adjustment.

Driven by motor, or powered by air, Milton Roy Pumps meter practically any liquid . . . in capacities from 3 milliliters per *hour* to 45 gallons per *minute*, against pressures up to 25,000 pounds per square inch. They are available as single or multiple units or as component parts of complete chemical feed and control systems. We invite your inquiries.



New Bulletin No. 553 tells the complete story on Milton Roy Motor-Driven Controlled Volume Pumps and their application. Write for your free copy.

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CONTROLLED VOLUME PUMPS AND AUTOMATIC CHEMICAL FEED SYSTEMS

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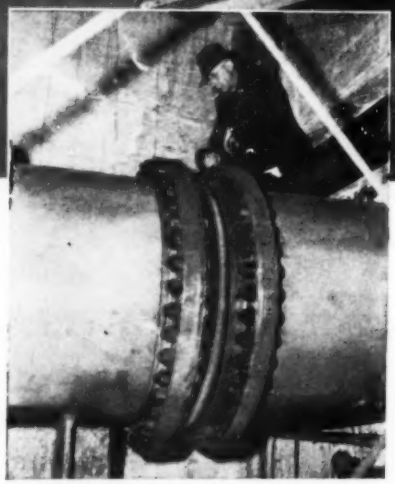
26 years under pressure... and these U. S. Rubber Expansion Joints are still full of vigor!

Yes, for more than a quarter of a century these U. S. Expansion Joints have been connected to the pipe lines carrying cold river water into an electric power plant. They are still in good working condition!

Only United States Rubber Company can claim such service records—for "U.S." is the manufacturer who developed, produced and introduced rubber expansion joints to industry. "U.S." files are filled with long-service records like this.

U.S. Expansion Joints are economical, flexible connections used in pressure and vacuum lines to prevent excess stress due to expansion, contraction and misalignment. In pipe lines, they insulate against vibration and prevent the transmission of noise.

You don't have to put up with pipe line troubles. Simply call any of our 25 District Sales Offices, each staffed with engineers. Or write to address below.



The U. S. Expansion Joints shown here (20" joint, above—48" joint, below) have been conducting cold water into an electric power plant for 26 years, yet are still in good condition.

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(*Continued from page 69*)

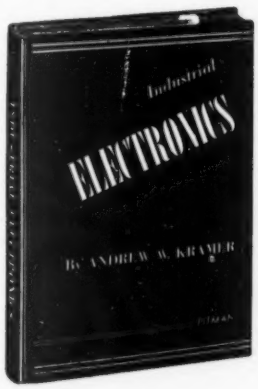
pump and the electric fuel oil heater are energized. Fan is operated for an adjustable interval to purge the furnace. This starting phase is continued until proper fuel oil pressure and temperature are indicated on the controlling equipment. (2) Burner motor starts. (3) Gas-electric ignition system is energized with automatic (adjustable) timer for the release of the magnetic oil valve. (4) The magnetic oil valve opens to supply fuel properly heated at correct temperature and at low (starting) firing rate. (5) Flame failure safety circuit is shunted during the fuel release cycle. (6) After a fixed time cycle for proper ignition, the flame failure safety circuit is opened to check the flame. Usually an electric eye is employed. A satisfactory flame will permit operation to continue and the gas-electric ignition system to be shut down.

The burner will increase its firing rate in keeping with steam demands, responding through the boiler pressure fluctuations. After steam pressure is raised, the supply to the steam fuel oil heater is automatic. Any restarting will automatically follow the regular starting sequence, or can be initiated by pressing a restart button. Adjustment of various controls is the only thing then remaining for the operator.

Maintenance — Package boilers of this type, because of their basic construction, generally give relatively maintenance-free service — excepting, of course, inspection and work done in a regular plant maintenance program. Water-cooled furnaces effectively cool furnace gases and prevent destructive effects of slag-forming oils to the refractory. Soot blowers on many units extend the entire length of the boiler and make tube cleaning easy and effective. Simpler water treatment also reduces any maintenance troubles. Access to the furnace is usually made through a door; access to tubes and boiler proper is provided for in some cases by removable casing panels. All in all ease of maintenance is one of the more attractive advantages of package boilers.

Performance — Years of dependable service have proved the all-around performance of these units. Efficiency is good, quality of steam is high, and availability is excellent.

Numerous tests on many of these boilers, and those of *Groups I* and *II*, have shown that package units are consistently capable of producing 99+ per cent dry steam at efficiencies (thermal) often approaching 82 per cent. One such test, conducted in 1949, on a water-tube package boiler with a forced-draft air-atomizing oil burner, forced and induced draft fans, and installed outdoors gave evidence of the highly satisfactory performance characteristics of these units.



a practical new book about Electron Tubes

. . . what they are
. . . how they work
. . . how they can be used
. . . what they can mean to you

INDUSTRIAL ELECTRONICS

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This new book explains in clear, simple, non-technical style the basic principles of electronics, and how these principles can be applied in industry. Electronics has been solving the unsolved problems. Whether it is navy beans, opening doors at a shadow, or measuring the thickness of red-hot steel plates, the electron is the newest and most efficient force captured by science. This book should be invaluable for the practical maintenance or operating executive or engineer. 311 pages, 229 illustrations, $6.00.

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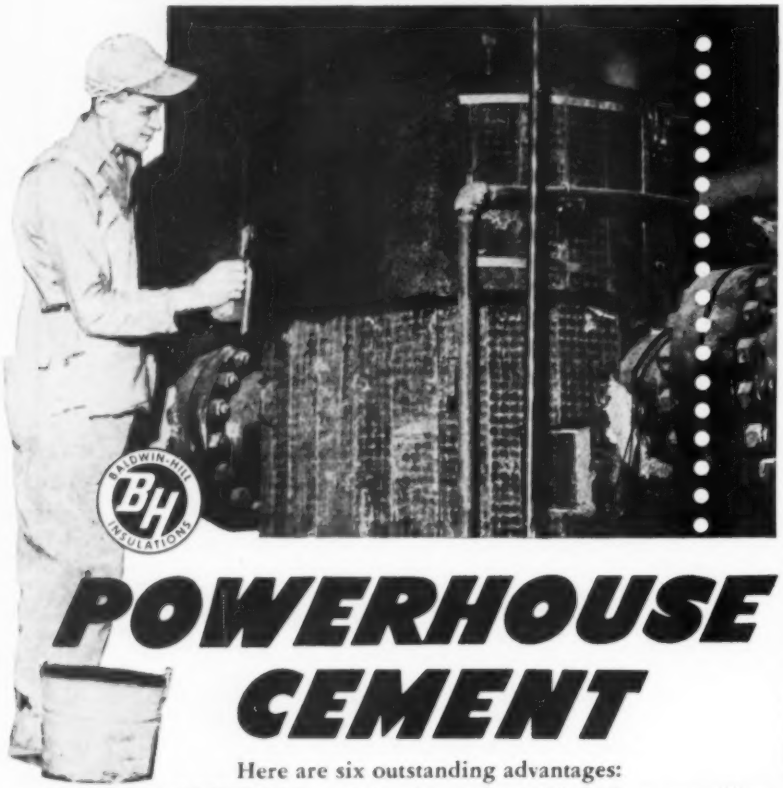

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- GREATER ECONOMY . . . 100 lb. covers 120 sq. ft. ¼" thick or 30 sq. ft. 1" thick. Low material cost and single coat application provide low over-all installation cost.
- NO WIRE MESH . . . In many instances can be trowelled directly on blocks, blankets, or other surfaces, thus saving costly application of reinforcement.
- DRIES WITHOUT CRACKING . . . Negligible lineal and volumetric shrinkage provides freedom from drying-shrinkage cracks.
- NO WEATHER WORRIES . . . Applied outside, it withstands drenching rain within two hours of application.
- PAINTABILITY . . . The smooth, firm, crack-free surface is perfect for finishing with oil-base or water-base paints.

For further information, get in touch with B-H Engineered Insulation Service.

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WATER TUBE PACKAGES

(Continued)

POWER ENGINEERING gratefully acknowledges the cooperation of the following manufacturers of steam generators, package and otherwise, in the preparation of this article:

American Hydrotherm Corporation; Babcock & Wilcox Company; Bigelow Company; William Bros. Boiler & Manufacturing Company; Clayton Manufacturing Company; Combustion Engineering-Superheater, Inc.; Condenser Service & Engineering Co.; Crotty Manufacturing Company.

Erie City Iron Works; Foster Wheeler Corporation; Heilman Boiler Works; International Boiler Works Company; E. Keeler Company; L. O. Koven & Brother, Inc.; Mund Boilers, Inc.; Murray Iron Works; Petro-Chem Development Company; Riley Stoker Corporation; Springfield Boiler Company; Steamaster Automatic Boiler Company; Struthers Wells Corporation; Titusville Iron Works.

Union Iron Works; Vapor Heating Corporation; Henry Vogt Machine Company; Wickes Boiler Company.

Under load conditions between 45 and 100 per cent there was a clean fire, low excess air requirement, high CO_2 output and a clear stack exhaust. A final test showed the unit was capable of operation at approximately 20 per cent over rated maximum steaming capacity with only a slight decrease in efficiency. Overall maximum efficiency was approximately 78 per cent, using a distillate fuel oil.

Another test, this time on a smaller unit, resulted in an overall maximum efficiency of about 82 per cent. Complete results of this test are shown in the table on page 69.

Obituaries

Arnold Pfau

ARNOLD PFAU, 79, hydraulic engineer and retired consulting engineer of the hydraulic department of Allis-Chalmers Mfg. Co., died February 8, in Roanoke, Ill. He has resided there since his retirement in 1946.

Born and technically educated in Switzerland, Mr. Pfau was originally connected with the water wheel builders, Esher-Wyss & Co. Later he became chief engineer in the hydraulic department of Ruston & Co., Prague, Bohemia.

Mr. Pfau was one of the organizers in 1904 of Allis-Chalmers hydraulic turbine department. He served as consulting engineer for more than 30 years under W. M. White and later under J. F. Roberts, now a vice president of the company. During his more than 40 years of active service with Allis-Chalmers, he was granted many patents relating to design improvements of hydraulic turbines in general and their accessories.

Mr. Pfau was identified with major impulse wheel installations in this country, helping to bring about much of the present day high efficiencies of this type

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ENGINEERING News
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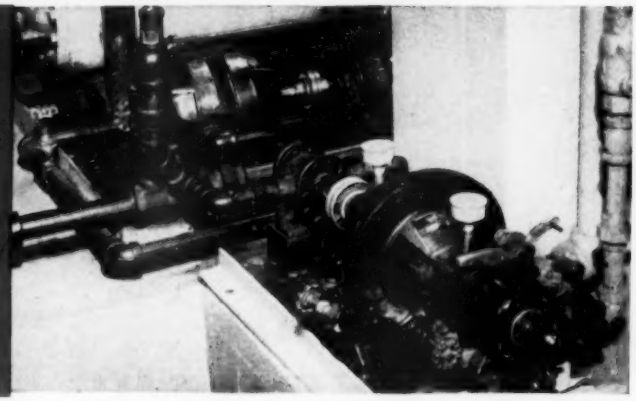
SK GEAR PUMPS ASSURE CONSTANT BOILER PRESSURE



Candy manufacturing processes at WHITMAN'S Chocolates are highly mechanized. Constant boiler pressure must be maintained to operate the various processing equipment which controls the quality of WHITMAN'S fine candies.

Three boilers, each equipped with two burners are responsible for generating 375,000 pounds of steam per day at the company's Philadelphia plant.

Boiler loads fluctuate widely, due to the complexity and operating demands of the processing equipment. With a minimum of effort, load fluctuations are easily met and boiler pressure held constant.

To insure a continuous flow of heavy fuel oil to the burners, a motor driven SK Gear Pump is used. Another SK motor driven pump and a steam turbine driven SK Gear Pump are utilized as standbys.

The turbine driven unit is especially selected to protect operation in the event of electric power failure.

Highly viscous Bunker "C" Fuel Oil, preheated to 90° to 100° F., is pumped to the main oil heaters and thence to the burners at proper atomizing and burning temperature. WHITMAN'S engineers report that SK Gear Pumps have proved highly satisfactory in their plant because the pumps: (1) operate continuously; (2) pump oil at even pressures; (3) require a minimum of maintenance.

Bulletin 17-A covers, in detail, the wide range of Gear Pumps manufactured by SK. Send for a free copy.

SCHUTTE and KOERTING Company
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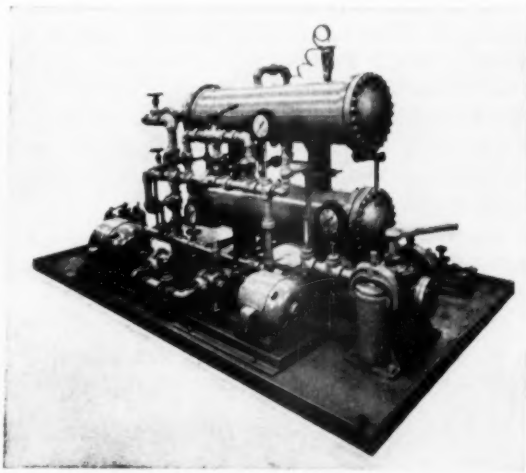
An integral part of the equipment installed in the new and very modern power plant of National Brewing Company, Baltimore, Md., is the SK Duplex Pumping, Heating, and Straining Unit shown.



The "package" consists of an SK Duplex Suction and a Duplex Pressure Strainer, two SK Fuel Oil Heaters, two SK Gear Pumps, and accessory equipment.

The unit handles 19 gpm of Bunker "C" Fuel Oil at 125 psig. The oil suction temperature is about 90° F., the oil heater outlet temperature is 200° F., and steam pressure averages 125 psig.

SK "Packaged" Units of this type are currently in use throughout the country in municipal and industrial power plants and other oil burning installations.

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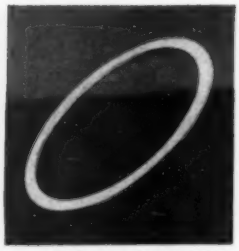
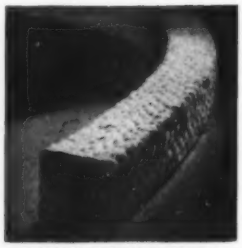
GARLOCK CHEVRON Hydraulic Packings



GARLOCK GUARDIAN Asbestos-metallic Gasket

GARLOCK KLOZURE Oil and Grease Seals for Bearings



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OBITUARIES

(Continued)

of hydraulic turbine. He was an expert on butterfly valves and hydraulic turbine governors, being a recognized authority on speed regulation and related subjects.

In addition to contributing articles to the technical press, Mr. Pfau presented a number of papers before the American Society of Mechanical Engineers, of which he was a member. He will long be remembered for his *Hydraulic Handbook* dealing with principles of design and practical problems of speed and pressure regulation.

Of high international reputation in his day, Mr. Pfau lived through a long and interesting span of water power development — from a time when water wheels of a couple of thousand horsepower were considered large to present day achievements, when 115,000-hp turbines for Hoover Dam, and 140,000-hp units for the Kemano plant in British Columbia were almost taken for granted.

New ENGINEERING BOOKS

A New Theory of Gravitation, by Dr. Jakob Mandelker; First Edition; 25 pages; 5¾ by 8¾ in.; cloth; published by the Philosophical Library, 15 E. 40th Street, New York, N. Y.; 1951. Price $2.75.

This little book, only 25 pages, develops a new theory of gravitation which harmonizes with the polar nature of electrostatic and magnetic fields. The fundamental property of all forces encountered in nature is bipolar manifestation. Whether mechanical stresses of tension or compression or electric or magnetic forces of attraction and repulsion, they always evidence themselves in pairs of a dual character. One exception, however, or one apparent exception, seems to exist in gravitation, that mysterious force by which masses and material bodies attract each other. The correlative force of repulsion seems not to exist in gravitation.

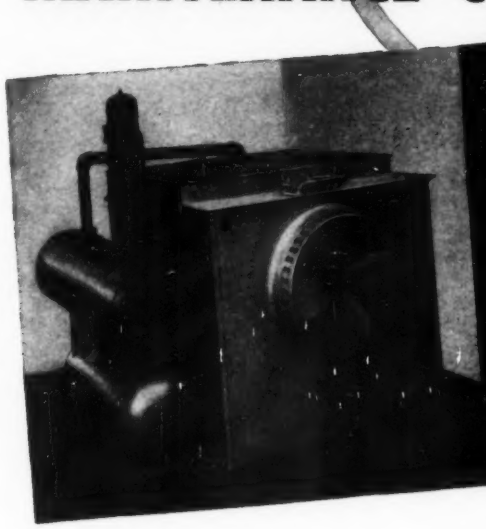
In electricity and magnetism we find two types of forces, negative and positive. If a pair is of the same sign, they repel each other; if they are of different signs, they attract each other. When we try to apply the electric and magnetic analogy to gravitation, however, we encounter only attraction.

Along with many others, Dr. Mandelker has given this question a great deal of thought. Indeed, his studies along this line have enabled him to put forth not only this new theory of gravitation, but also, in 1949, a new system of what he calls energy mechanics — a system in which the central inertia notion of classical mechanics, the Mass M, has been replaced by the superior energy concept of matter, MC^2. This work

New

SAVES WATER and CUTS MAINTENANCE COSTS . . .

Illustrations show two views of a 35 ton Condenser Tower prior to partial disassembly for shipment.



Vogt

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FOR CONDENSING REFRIGERANTS

SINGLE RESPONSIBILITY:

Vogt, leading builder of refrigeration condensers, assumes responsibility for engineering the unit. Only one purchase order needed.

SHOP FITTED:

To cut down field assembly labor. Requires no cutting or fitting of pipe.

Designed for today's water conservation requirements, and to keep refrigeration costs low, the *new* Vogt Condenser Tower meets the need for a proven, readily cleanable condensing unit.

The Vogt Condenser Tower consists of a multipass straight tube condenser, a receiver, an oil trap, a cooling tower, and a water pump. Removable cast iron heads permit easy cleaning of the condenser tubes.

Water costs are extremely low since the cooling water is recirculated continuously and requires only a small amount of makeup to replace losses due to windage and evaporation.

Condenser Tower units are available in capacities ranging from 5 to 50 tons refrigeration. Additional information will be furnished upon request.

HENRY VOGT MACHINE CO., Louisville 10, Kentucky

BRANCH OFFICES: NEW YORK, PHILADELPHIA, CLEVELAND, CHICAGO, ST. LOUIS, DALLAS, CHARLESTON, W. VA.

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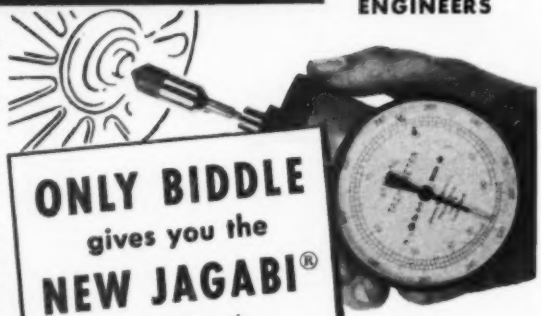
Tips on TACHOMETERS for MECHANICAL ENGINEERS

Longer Instrument Life
Lower Repair Bills

New models AO and DO Jagabi Hand Tachometers with "Overspeed Protection" are exclusive with James G. Biddle Co. These highly accurate and always reliable instruments are equipped with a special friction coupling that minimizes the damaging abuse of occasional overspeeding and too-sudden acceleration if accidentally used at too-low range setting. This protection is also available in the Jagabi Tachograph.



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FAMOUS Dr. HORN *HAND TACHOMETER*

Many consider Dr. Horn to be the finest speed measuring device obtainable. Gives instantaneous readings of rotational—or linear and peripheral speeds—regardless of the direction of rotation. Measures 6 ranges from 25 rpm to 30,000 rpm. Operates with equal precision in vertical, horizontal or slanting position. Simple mechanism. Overspeed protection. Low maintenance. Long life. James G. Biddle Co. is sole U.S. distributor.

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TWO-IN-ONE JAGABI® TACHOSCOPE

Combines speed indicator and stop watch. Replaces "human element" of error in starting and stopping with higher accuracy of calculation because Tachoscope can be operated for longer period. High precision instrument for measuring machine speeds up to 20,000 rpm. Frequently used as a standard for checking other speed measuring instruments. The high quality stop watch may also be used independently.

SPEED MEASURING BULLETIN. A selection chart of Speed Measuring Instruments for specific conditions is a feature of BULLETIN 35-PE.

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was described in Dr. Mandelker's book, Principle of a New Energy Mechanic, reviewed in these columns in 1950.

In his thinking about gravitation, Dr. Mandelker again uses what he calls the energical point of view, and his premise is that *radiation* is a manifestation of force that is directly opposed to gravitation. According to Einstein's most significant findings, every kind of energy E manifests the same inertia characteristics as material bodies. It possesses a mass M of the value $M = \frac{E}{C^2}$ in which C denotes the velocity of light, as well as the limiting value for any velocity. On the other hand, every piece of matter contains the so-called energy of constitution of the value MC^2. This concentrated matter energy has been interpreted in the author's work on mechanics as being of a potential nature. In the case of radiation, with the velocity C, this energy manifests itself in its kinetic radiational aspect. The smallest imaginable quanta radiate out in all directions with the velocity of light.

To say the least, this is an intriguing idea. It conforms with the duality principle, the bipolar manifestation of forces in nature, and if this conception of gravitation as the correlated counterforce to the radiation is true, it at once solves a problem which has baffled astronomers and scientists for many centuries.

This, then, is Dr. Mandelker's premise, that the outwardly-directed radiational force is coordinated as the counterforce to the inwardly-directed force of gravitation. In his book Dr. Mandelker develops the basic ideas in their mathematical physical form and relationship, and he endeavors, step by step, to interpret and verify the presumed interconnection between matter energy and gravitation. Dr. Mandelker is Assistant Professor of Mechanics at the Georgia Institute of Technology at Atlanta, and his book is well worthy of the consideration of anyone endowed with a philosophic turn of mind.

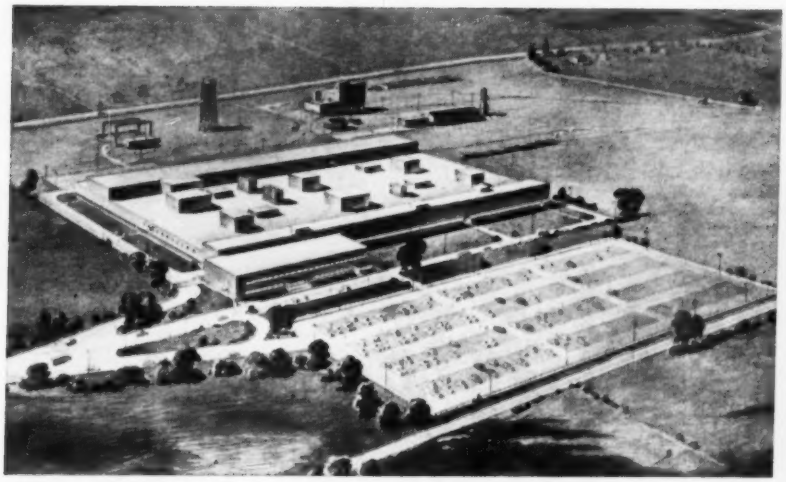
★ ★ ★

Mechanics, by J. L. Meriam; two volumes, Volume 1 — Statics, Volume 2 — Dynamics; first editions; 6 by 9 in.; cloth binding; published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y.; price $4.00 each.

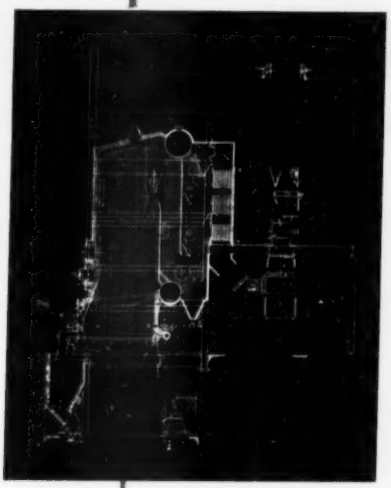
Statics, the first of two volumes covering basic engineering mechanics, integrates the usual pre-engineering background of physics, mathematics, and graphics. The author progresses in easy stages from fundamentals to advanced theory; always he emphasizes the importance of principles and problems which apply them. As a result, 672 practical problems, taken from many engineering fields, act as a tonic to the reader's thinking powers. Answers are given for more than half of these problems, and all are profusely illustrated.

Dynamics, the second volume, is a sequel and companion to volume 1 and follows a similar pattern and emphasis.

TWO WICKES STEAM GENERATORS will help heat the CATERPILLAR TRACTOR CO.'s new plant at York, Pa.



CONTRACTORS: Consolidated Engineering Company Inc., Baltimore, Md.
CONSULTING ENGINEERS: Whitman, Requardt & Associates, Baltimore, Md.



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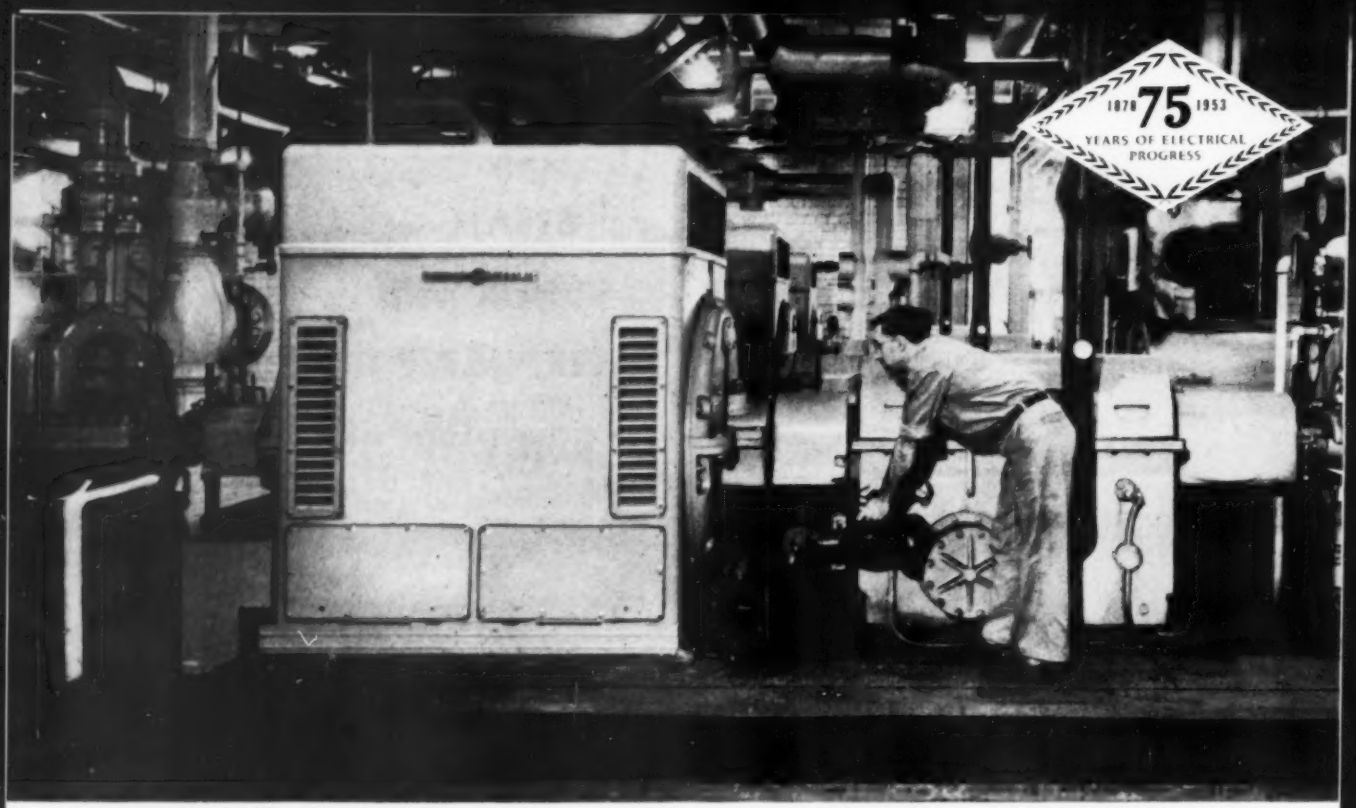

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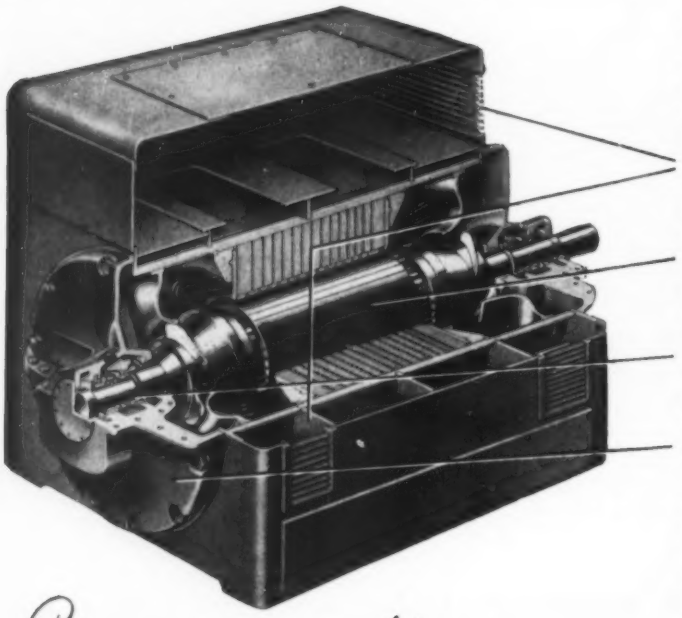

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Kinematics is treated separately from kinetics, but for easy reference the study of motion is divided into the same categories used in the section on force, mass, and acceleration. Emphasis is on the direct use of the equations of motion, although the inertia-force method is described and used alternately. The work-energy chapter stresses the type of problem for which this method is superior to the other by the use of the force-mass-acceleration equations. The treatment of impulse and momentum leads to the interesting subject of variable mass which is illustrated with problems on rocket and jet propulsion. An introduction to mechanical vibrations and other cyclic motions is presented in the last chapter on periodic motion.

★ ★ ★

Cooling Towers by J. Jackson. Size 6 by 10 in.; illustrated; cloth bound; 104 pp including index. Published by Butterworths Scientific Publications Ltd., copies available from Butterworth & Co., (Canada) Ltd., 1367 Danforth Ave., Toronto 6, Ontario, Canada. Price $3.50.

This handbook on mechanical-draught water cooling towers should be of particular interest to the non-specialist who may be placed in a position requiring knowledge of cooling tower construction and operation.

Several methods of water cooling are covered briefly, even though this book is chiefly concerned with the mechanical-draught towers. An entire chapter is devoted to Merkel's total-heat theory. Another chapter outlines the use of serrated wooden grid packing in towers, with a short example of design problems. Tower testing is also covered in the text.

Based on the reverse relationship of cooling hot gas and cooling water with air flow, hot gas cooling towers are dealt with in one section of the book.

The appendix carries such items as the derivation of the total-heat equation, discussion of wet-bulb temperature, comparisons of tower types, and economic factors in cooling water industrially.

★ ★ ★

The Nature of Some of Our Physical Concepts, by P. W. Bridgman; First Edition; 64 pages; 6 by 9¼ in.; cloth. The Philosophical Library, 15 East 40th St., New York, N. Y. 1952. Price $2.75.

This is a book for those having a philosophical turn of mind; those who wonder and speculate about the ultimate reality of things. For some time Dr. Bridgman has been interested in a more articulate analysis of what he calls the "paper and pencil" and "verbal" components of some of our physical concepts. He has, he says, become increasingly appreciative of the importance of the role which our verbal demands play, not only in the structure of our formal theories, but also as a tool capable of suggesting new experiments.

The material in this book formed the content of a series of three lectures which

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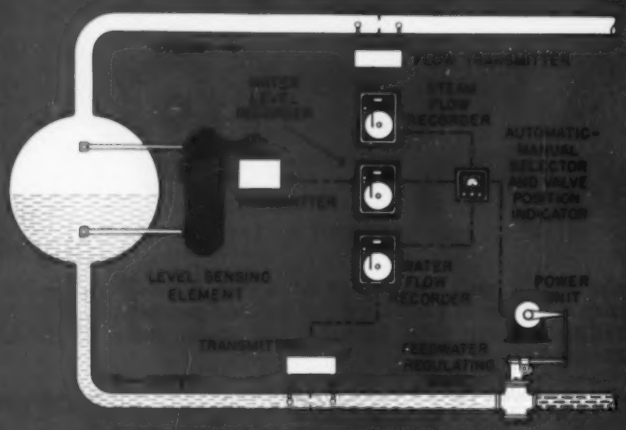

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Dr. Bridgman gave at the University of London in the spring of 1950. In the first one, he considers the general operational approach, the consequences of an operational analysis with regard to the field concept, the concept of empty space, and of the nature of light. The second and third lectures involve the fundamental concepts of thermodynamics and the phenomena of conduction of electricity in massive conductors.

Professor Bridgman is professor of physics at Harvard University and a winner of the Nobel Prize.

★ ★ ★

Writing the Technical Report by J. Raleigh Nelson; third edition; size 6 by 9 in.; 356 pp; cloth bound; published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y.; price $4.50.

Since a report is a communication of information, the person preparing the report should convey this information to the reader in best-organized manner possible. A report, says the author, should consist of the following parts: title page, synopsis or abstract, table of contents, introduction, body, and appendix. These fundamental steps for preparing technical reports are listed and elaborated upon in this book.

The book is divided into four parts. First, design and composition of the report are considered. Next, the text gives specific directions for the setup of both long and short form reports. The third part outlines a systematic procedure for the critical examination of a report. The fourth part presents a 16-week course in report writing which can be used as a basis for classroom purposes or as a guide for study for those in practice who wish to enlarge and clarify their appreciation of the fundamentals of report writing.

★ ★ ★

Modern Pyrometry by C. H. Campbell. Size 5½ by 8½ in.; 150 pp including index; illustrated; cloth bound. Published by the Chemical Publishing Co. Inc., 212 Fifth Ave., New York 10, N. Y. Price $4.00.

This book describes the principles of pyrometry and new pertinent developments. It has been written primarily for the metallurgist; however, engineers, chemists, manufacturers and technical workers who use high temperatures will find it useful.

Among the topics covered are the types and uses of thermocouples, lead wire and protection tubes; temperature indicators, recorders and controllers; resistance thermometers, mercury and bimetallic systems; applications, care and maintenance of pyrometers. The book also lists a glossary of terms used in automatic control and many references to the latest developments.

The appendix carries tables for the conversion of deg. F to millivolts for thermocouples containing different combinations of metals.

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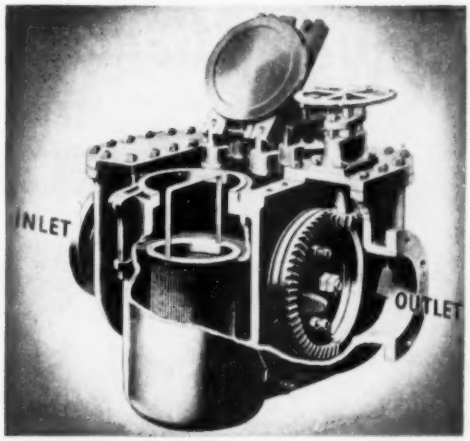

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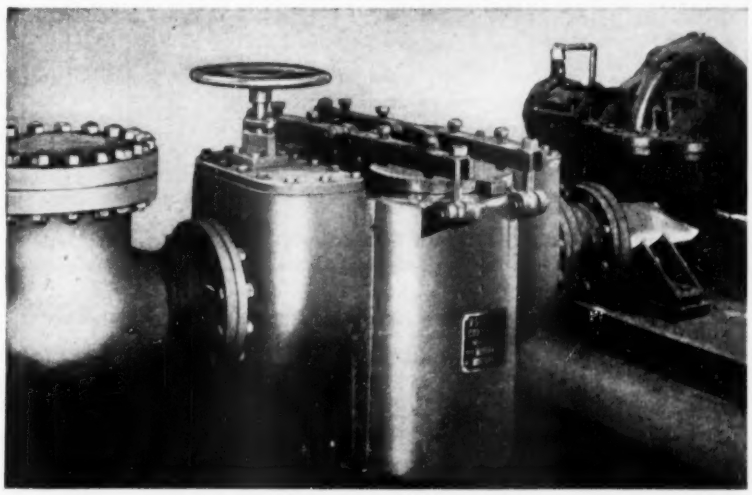

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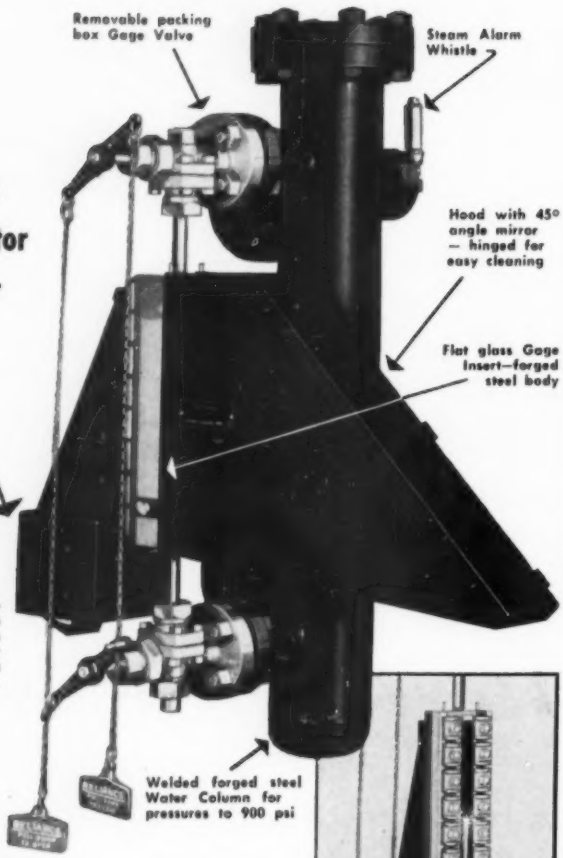
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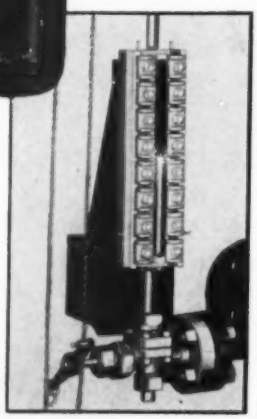

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Fuels and Combustion, by Marion L. Smith and Karl W. Stinson; first edition; 340 pages; size 6 by 9 in.; cloth binding; published by McGraw-Hill Book Co., Inc., 330 West 42nd Street, New York 36, N. Y.; price $6.50.

This textbook has been written to present to undergraduate engineering students and to engineers fundamental and factual information concerning solid, liquid, and gaseous fuels and the problems associated with their combustion. The general topics of fuel technology and the relationships of air, fuel, combustion products, and the heat released, are presented, the better to understand the problems involved in the application of combustion to furnaces, heaters, oil and gas burners, reciprocating internal-combustion engines, gas turbines, and rockets. Fundamental concepts of modern theories of oxidation are covered in an easily understood manner. While the book was developed for use in a fuels and combustion course which would follow fundamental thermodynamics and precede the application courses of steam power, internal-combustion engines, and heating and ventilating, it is so written that it can be used as a text at other levels by omitting certain sections. The eight main sections of the book are: fuels, stoichiometric analysis, thermochemical analysis, the process of combustion, physical properties of fuels, gas and oil burners, coal-burning equipment, and combustion in engines. A list of questions are included at the end of each section.

Since many aspects of this subject have been studied intensively for many years, the authors have made liberal use of and reference to the widely diversified literature in the field in their effort to present a modern, concise, and yet fairly comprehensive treatment of fuels and combustion.

* * *

North American Combustion Handbook. Size 6 by 9 in.; 322 pp including index; illustrated; cloth bound. Published by the North American Manufacturing Co., 4455 East 71st St., Cleveland, Ohio. Price $2.00 plus postage.

This book is a basic reference on the art and science of industrial heating with gaseous and liquid fuels. The opening chapter presents the elements of combustion in simple language.

A section is given to the important subject of combustion analysis; this includes exemplary computations and material on flue gas analysis.

One of the factors that comes to mind in the design or operation of systems using liquid or gaseous fuels is the losses incurred by their flow. This is treated along with the underlying mechanics of flow.

Appendix contains many helpful engineering tables. Glossary carries many terms common to study of combustion serving as an aid in understanding the related language.

CATALOG LIBRARY

(*Continued from page 116*)

valuable source book of ideas for control station planners. Bailey Meter Co.

215 Control Centers — This 31-pp application booklet (B-5621) on control centers stresses the case for centralizing all controls of an entire system in one group of enclosures. Discusses the characteristics of control centers that make for flexibility of use, ease of servicing, safety. Three types are described, and the various electrical components that make up typical units are illustrated. A three-step building-block system of planning control centers is given. Westinghouse Electric Corp.

216 For Combining Control Signals — The improved design of company's Ratio Totalizer is described and pictured in 8-pp Bulletin 5452. This simplified versatile mechanism is a pneumatically operated control for combining input control pressures and spring forces, and producing an output control pressure based on addition, subtraction, multiplication, division or other functions. Hagan Corp.

217 Control Equipment — Catalog 003, 32 pp, presents company's equipment for the control of liquids and gases for water and sewage works, power and process industries. A well illustrated booklet, it lists many types of controllers, gages, manometers, valves, venturi tubes. Descriptions of the units, their operating characteristics, construction details, mountings, specifications and other data included. Simplex Valve & Meter Co.

218 Control Systems — This literature describes and illustrates control systems designed especially for the power industry. Shows how new developments in control systems contribute to efficient, economical operation of power generating stations. Panellit, Inc.

PUMPS, PUMPING

219 Centrifugal Pump Handbooks — Two instruction booklets covering the installation, operation and repair of company's single-stage single-suction and multi-stage centrifugal pumps are available. Suggest regular inspection procedures and include pages for maintenance records. Also provide handy tables explaining how to locate trouble and listing causes and cures. Bulletin 08X7813, 24 pp, covers single-stage pumps; Bulletin 08X7780, 48 pp, covers the multi-stage pumps. State choice or both. Allis-Chalmers Mfg. Co.

220 Rotary Pump Service Manual — The installation, operation and maintenance of rotary pumps are covered in 12-pp Service Manual 100-2. Subjects discussed include installing of foundation bolts, alignment, supporting vertical pumps, grouting, piping, suction lines, hot liquid pumps, rotation, packing, dismantling, reassembly, starting, operation and standing idle. Warren Steam Pump Co.

221 Condensed Pump Data — Form 4383-J covers more than 20 types of general service pumps, rotary pumps, sump and drainage pumps, condensate units, self-priming units, stainless steel pumps and high pressure pumps. In easy-to-find tabular form, each model is pictured along with its characteristics, applications, features and references to specific literature providing further information. Goulds Pumps, Inc.

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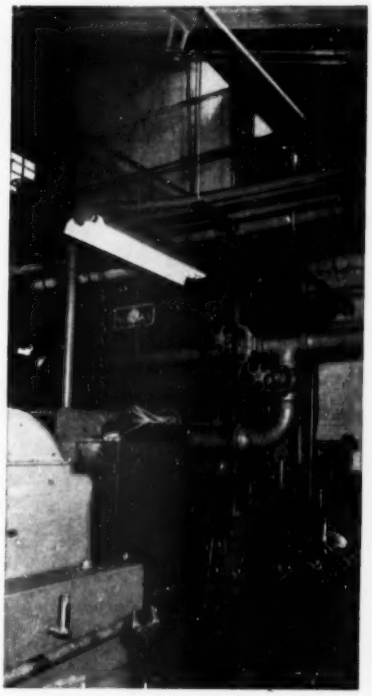

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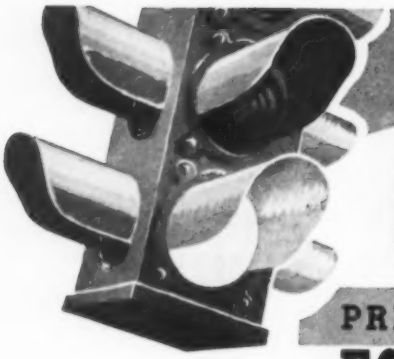

GREEN

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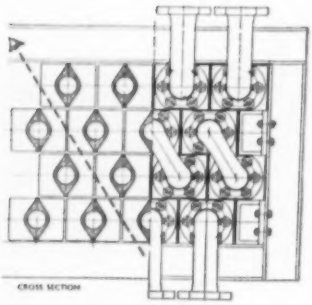
The Economizer with the "Diamond" Design



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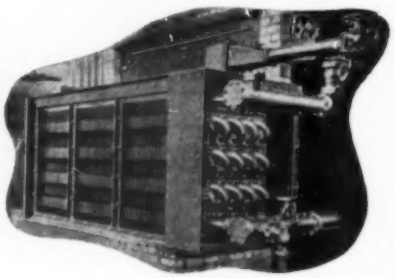

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222 Controlled Volume Pumps — Bulletin 351, 16 pp, describes company's air-powered controlled volume pumps, designed to pump practically any liquid in measured volumes accurate to within a fraction of 1 per cent. Pumps are reciprocating, positive displacement plunger types. Cross-sectionals show design and operating details. Controls and typical automatic feed systems are discussed. Milton Roy Co.

223 Boiler Feed Pump — A barrel-type boiler feed pump for high pressure, high temperature service and designed to go on the line quickly without preliminary warm-up, is the subject of 12-pp Bulletin 1525. Fully illustrated text explains automatic operation of hydraulic thrust balance incorporated in this pump. De Laval Steam Turbine Co.

Postage-free cards for ordering catalogs and bulletins are provided on pages 37 and 116

224 For Controlled Volume Pumping — Bulletin 300, 24 pp, describes Pulsafeeder piston-diaphragm pumps, stressing their no-stuffing box feature and noting that although basically a pump, this unit can do the work of a feeder, meter, instrument, filling machine, proportioner and sampler. Process Equipment Div., Lapp Insulator Co., Inc.

225 Boiler Feed Pumps — Bulletin 109, 16 pp, illustrated in color, describes centrifugal pumps for boiler feed service. Pictures construction and major parts, floating seal incorporated. Capacity data and vapor pressure tables included. Pacific Pumps, Inc.

PACKINGS, GASKETS, SEALS

226 Packings and Gaskets — Catalog P-100C, 32 pp, covers 95 most popular packings and gaskets in company's line, furnishing details of construction, service recommendations and size information. Includes charts showing specific recommendations for a wide variety of applications. Packing Div., Raybestos-Manhattan, Inc.

227 Seals for Bearings — Complete information on manufacturer's Klozure oil in grease seals for bearings is available in 100-pp Catalog 10. Fully illustrated in color, pictures all types of these seals, typical applications and lists sizes and part numbers. Also describes mechanical pressure seals for rotary shafts. The Garlock Packing Co.

228 Manual on Packings — Containing 84 pp of engineering and ordering information, Catalog 40 covers packings for practically every service. Includes packaging recommendation charts, conversion tables. The Belmont Packing & Rubber Co.

229 Packings for the Power Plant — Designed as a quick-reference aid, one feature of this compact 6-pp guide is a flow sheet of a rudimentary industrial power plant with each unit keyed to the proper packings and gaskets. Illustrated.

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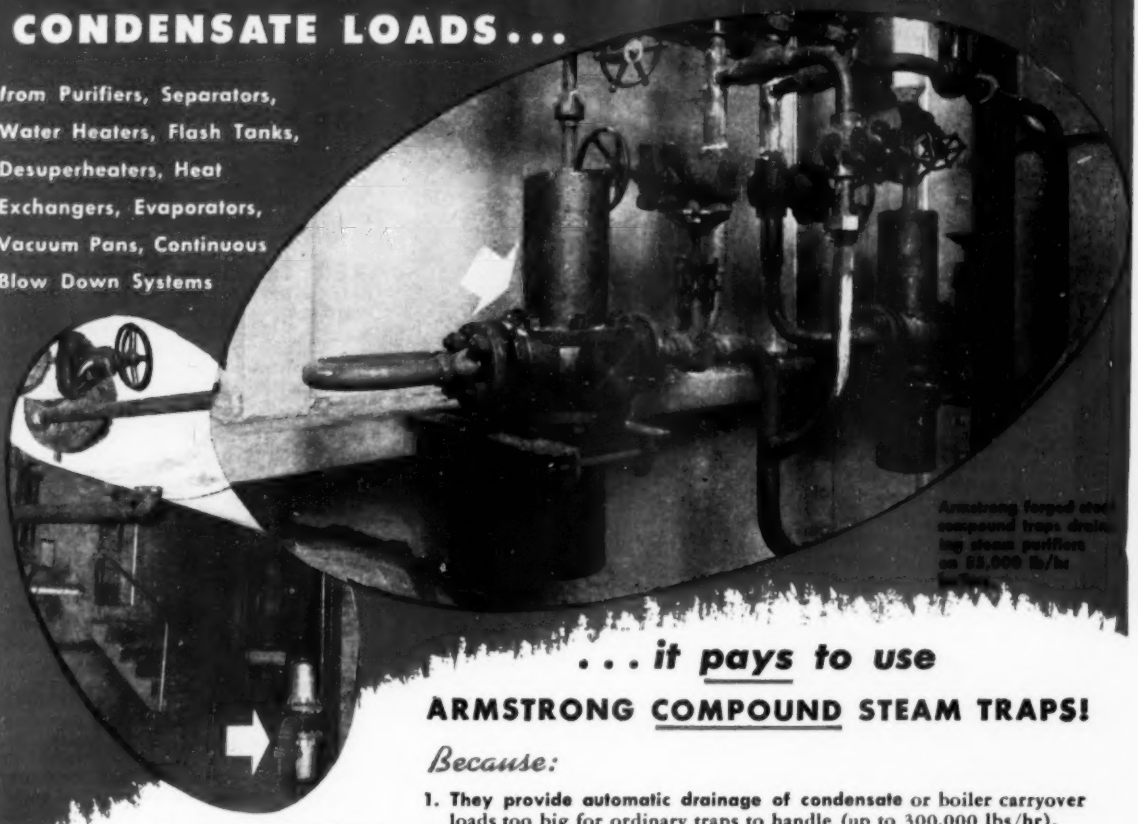

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Includes construction information, sizes. Johns-Manville.

230 Long Wearing Piston Packing — Form 4502, 8 pp, presents composition cups for packing pistons of air and hydraulic cylinders and reciprocating pumps. Engineering information covers properties, textures, temperature and pressure data, sizes. Darling Valve & Mfg. Co.

VALVES, TRAPS, PIPING AND ACCESSORIES

231 Safety Valve Engineering Data — How company's safety valve works and its operating advantages are explained in Bulletin 707. Includes dimensions on valve types, and also tables on superheat correction factor. Manning, Maxwell & Moore, Inc.

232 Check Valves — Twenty-pp Catalog 30 presents company's line of tilting-disc check valves made in iron, bronze and steel for working pressures to 3000 psi. Explains operating principle of tilting disc construction, discusses closing without slam, reduced loss of head, other advantages. Includes construction details, sizes. The Chapman Valve Mfg. Co.

233 Valve Specialties — Included in 90-pp Catalog A-50 is ordering and engineering information on automatic pressure flow and liquid level controls for steam, air, gas, water, oil, other fluids. Sections are devoted to pressure regulators, altitude valve, pump governors and strainers; lever, float and motor operated valves; pilot valves; back pressure, relief and non-return valves, steam trap and air vent; liquid level controllers; solenoid valves. Davis Regulator Co.

234 For Quick Valve Selection — Here's a 20-pp catalog digest providing ordering and application information on gate, globe, angle and check valves in bronze, iron, cast and forged steel construction, also valve accessories and parts. Illustrated and thumb indexed, includes pressure-temperature chart. The Ohio Injector Co.

235 General Service Valves — Bulletin E-160, 16 pp, describes and illustrates design and construction of company's quick-operating valves, explaining their application to blow-off service and on chemical process, soot blowers, water column blow-down, and other types of pipe line. Everlasting Valve Co.

236 Cast Steel Valves — This 56-pp catalog on cast steel valves includes information on globe, angle and check valves in 300, 600, 900 and 1500 lb pressure classes. Parabolic disk valves for hand or motor control of volume are also described. In addition to standard information on construction features, dimensions and weights, the booklet contains complete data on material specifications, preparation of welding ends, flange facings, and pressure-temperature ratings. Edward Valves, Inc.

237 Gate Valves — Literature is available on cast steel outside-stem-and-yoke gate valves; also on bronze, iron, steel and corrosion-resisting valves in a variety of types. The Wm. Powell Co.

238 To Get at Those Valves — This little folder describes a sprocket rim with chain guide. The rim adjusts to fit all valve wheels. Babbitt Steam Specialty Co.

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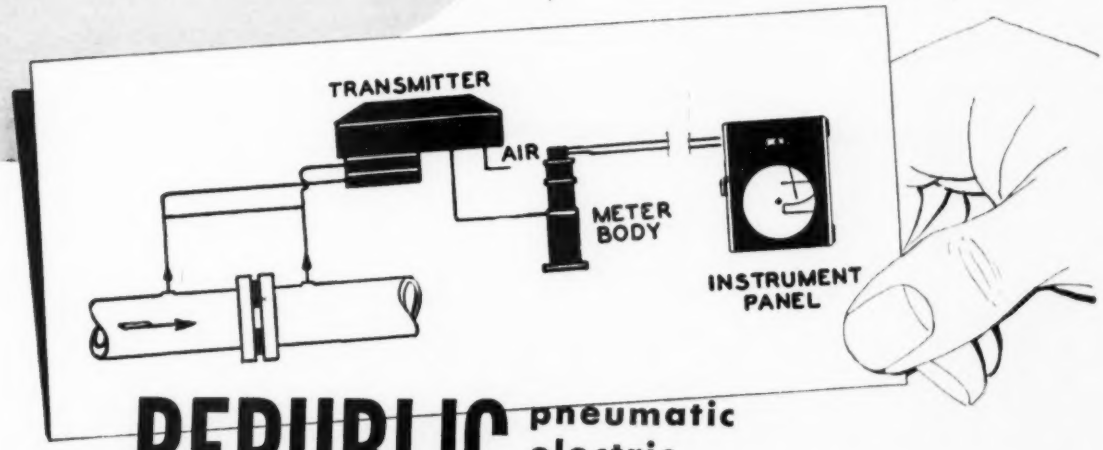

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to short lead lines and small measuring chamber in pneumatic transmitter—keeps dangerous or high pressure fluids out of control rooms and mercury-type meter bodies.

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can be furnished for measuring chamber to meet requirements of almost any fluid. Corrosive fluids do not come in contact with any other part of meter.

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When measuring hot liquids which are very viscous at room temperature, transmitter may be mounted on flow line to keep temperature of liquid in measuring chamber and flow line the same.

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meter body does not require large movements of mercury or oil—follows all flow, no matter how erratic or fluctuating.

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Flow information can be sent any reasonable distance. Electric meter body extracts square root from flow differential measurement, permitting use of uniformly graduated scales and charts.

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which include recorders, integrators and indicators, can be mounted separately or together, as desired.

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239 Solving Steam Trap Problems — This 36-pp catalog on steam traps contains specifications and capacities on steam traps, float traps, air release valves and pipe line strainers. Tells how to calculate condensation loads and select traps for all classes of equipment, including unit heaters, jacketed kettles, autoclaves, submerged surfaces, steam mains and header drips. Gives pointers on how to install and service traps. The V. D. Anderson Co.

240 Steam Trap Book — Catalog J, 44 pp, serves as a manual of trapping practice. Includes a catalog section giving physical data and prices on cast semi-steel and forged steel inverted bucket steam traps, compound steam traps and ball float air and air relief traps; a handbook section explaining how to calculate condensate loads and select traps for all classes of equipment; a maintenance section explaining trap installation, trouble-shooting and repair. Armstrong Machine Works.

241 Steam Trap Reference Manual — Bulletin T-1740, 24 pp, tells why and where steam traps should be used; explains desirable trap features. Advantages of company's impulse steam traps are described, their operation illustrated. How to figure trap sizes and how to size condensate return lines are told and capacity and pipe dimension charts and thermodynamic properties of saturated steam included. Yarnall-Waring Co.

242 Steam, Air and Gasoline Traps — Illustrated Catalog 751, 32 pp, provides capacity tables, installation diagrams and a section containing data, charts and formulas for determining proper size trap for specific applications. Covers thermostatic steam traps for pressures to 225 lb, expansion steam traps, weight-operated traps for steam, air and gasoline, also piston-operated traps. W. H. Nicholson & Co.

243 Piping Pointers — This is company's highly popular 36-pp manual covering fundamentals of sound piping practices. Discusses various types of valve designs and how each should be used. Pictures and names more than 80 fittings and contains illustrated how to-do-it features. Includes 8 pp valve selection guide. Crane Co.

244 Unions and Fittings — Twelve-pp Catalog 50 covers manufacturer's line of unions of all types, elbows, tees and fittings. It describes and illustrates special features. Dart Union Co.

245 Handbook on Fittings, Flanges — Catalog wf-1950, 68 pp, offers working information on seamless carbon steel welding fittings and forged steel flanges. Includes dimensional tolerances, thread standards and threading practice; service pressure ratings, physical and chemical requirements. Grinnell Co., Inc.

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246 Duplex Strainer — This literature describes company's Duplex strainer with single handwheel control. Shows how it is designed with only one stuffing box and can be cleaned under full flow. R. S. Products Corp.

247 Data on Strainers — Several types of pipe line strainers for all purposes in sizes from ½ to 36 in. are described and illustrated in 16-pp Manual 951. Summarizing important developments, booklet carries information on factors to consider in selecting a strainer for a specific application. J. A. Zurn Mfg. Co.

248 Rubber Expansion Joints — This 12-pp catalog presents advantages and applications of a line of rubber expansion joints. Standard, tapered, multiple-arch and offset spool type joints are described and pictured, also sleeve type joints. Includes dimensions, suggestions for installation and maintenance. Typical installations are pictured and diagrammed. Goodall Rubber Co.

BOILERS, GENERATORS

249 Improved Steam Generator — Bulletin 2000, 28 pp, explains advance design features that distinguish this manufacturer's generator from other unit steam generators. Describes and illustrates engineering differences of component features. Also shows how these components are constructed, assembled and tested. Another section gives data, and dimen-

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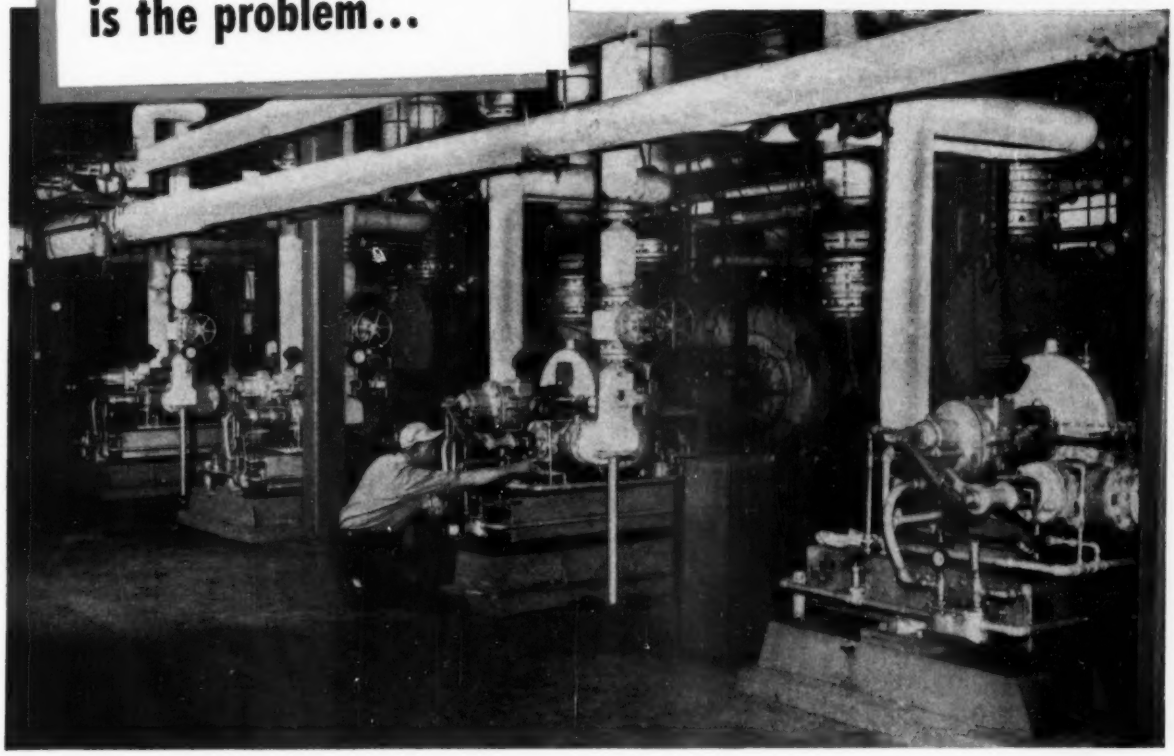

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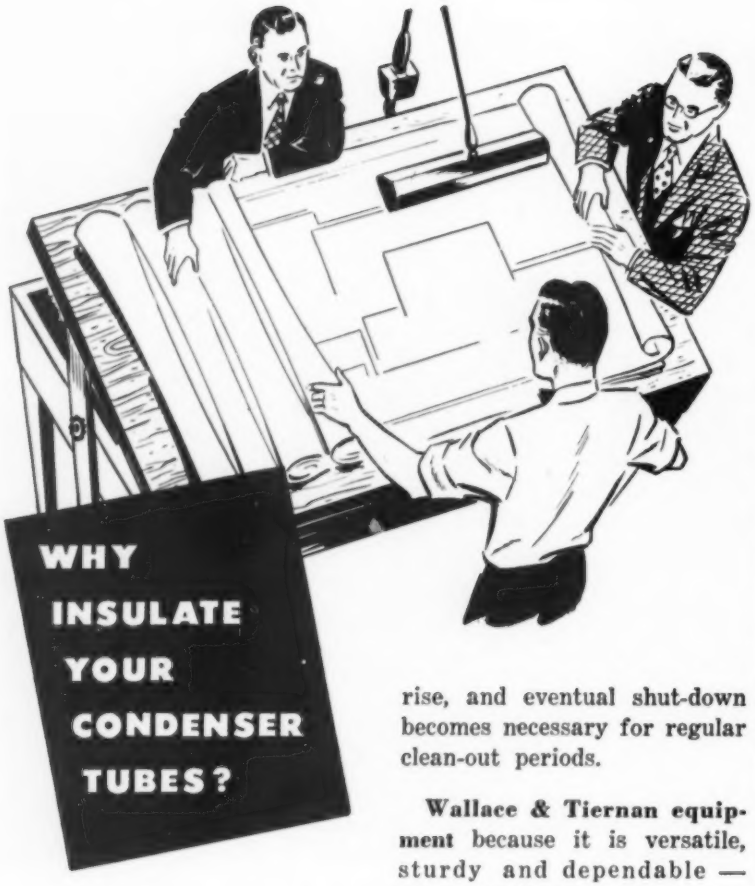

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sions and standard and accessory equipment for the units which range from 20 to 6000 hp, for pressures to 250 psi. Preferred Utilities Mfg. Corp.

250 Shop-Assembled Boiler — Sixteen-pp Bulletin G-76, completely describes and illustrates company's Type FM water-tube integral-furnace boiler, made in standard sizes from 2900 to 28,000 lb of steam per hr, pressure to 250 psi. Savings in erection, installation and moving costs are stressed. Capacities, dimensions and weights given. The Babcock & Wilcox Co.

251 Re-circulation Steam Generator — Here's a 6-pp folder on a controlled re-circulation steam generator, describing its development and uses, such as applications where steam is required in remote locations, where demands are intermittent, or load fluctuating. Combustion Engineering-Superheater, Inc.

252 Steam Generators — Twenty-pp Bulletin SB43, 20 pp, describes company's VL factory assembled generators combining 2-drum water-tube boiler, integral water cooled furnace, brick work, insulation and steel casing. A large cutaway illustration shows design details, and gas travel. Use of generator with various fuels and firing arrangements is covered. Erie City Iron Works.

253 Steam Boilers — Form SG 128-749 is a 12 pp catalog illustrated with photos of steam boilers for processing and heating, ranging from 15 to 500 hp and 15 to 200 psi. Includes diagrammatic cross-section of four pass design characteristic of company's boilers. Cleaver Brooks Co.

TUBING AND ACCESSORIES

254 Condenser Tubes — Excellent information on condenser tubes and their service life is given in this 40-pp illustrated booklet. Subjects discussed include corrosion of condenser and heat exchanger tubes, corrosion resistance and control, the selection of tube materials, and the composition and physical properties of company's alloys. Details on proper installation are presented, as are specifications, conversion tables, weights of tubes and alloys. Scovill Mfg. Co.

255 Life Extension for Condenser Tubes — This 32-pp extensively illustrated booklet reports on research into the causes of corrosion and means of combating them, as well as the choice of condenser tube materials. Points out that Admiralty metal, long a standard for power plant condenser tubes, works satisfactorily in most installations, but other alloys may be necessary in some circumstances. Revere Copper and Brass, Inc.

256 Nickel Pipe and Tubes — Bulletin T-17 is a 27-pp technical bulletin on the fabrication and design of nickel and high nickel alloy pipe and tubing, illustrated throughout by drawings and photos. Presents tables on mechanical and physical properties, ASME code requirements, recommended welding procedures. The International Nickel Co., Inc.

257 Double-Walled Tubing — Technical Bulletin 1950, 12 pp, presents tubing designed for conditions where single-walled tube can't withstand simultaneous attack from two types of corrosive media. Describes and illustrates construction, illustrating possible metal combinations. Explains tubing's use in ammonia refrig-

eration, boilers, steam generators. Discusses heat transfer properties, high temperature use. Bridgeport Brass Co.

258 Tube Cleaners — Catalog 76-A provides 48-pp of information on manufacturer's line of tube cleaners. Following equipment selection and operating hints, this practical catalog describes and pictures cutter heads and drill heads, brushes, and motors, giving sizes, application information. Electrically driven equipment, air valves, hose, lubricators presented. Thomas C. Wilson, Inc.

259 Rotary Tube Cleaners — Bulletin R-105 presents air and water driven rotary tube cleaners and cleaner accessories. Illustrates several models and heads, discussing special features. Roto Div., Elliott Co.

260 To Avoid Tube Corrosion — Bulletin TR-514 is an 8-pp illustrated article discussing corrosion as a major factor in shortening the life of boiler tubes. Indicates that, in low pressure boilers, corrosion is the largest single cause for replacement of tubes. Points out types and causes of corrosion and gives general rules to follow to get maximum service life from boiler tubing. Tubular Products Div., The Babcock & Wilcox Co.

HEAT EXCHANGERS

261 Heat Exchangers — The advantages of film-type heat exchangers in the solution of cooling water problems, even when dirty water must be used, are stressed in Bulletin HE-7, 8 pp. Explains and illustrates design details. Discusses use of these heat exchangers in power plants, chemical plants, and in a compression plant. Henry Vogt Machine Co.

262 Finned Tube Heat Exchanger — Bulletin 1400, 20 pp, fully describes the company's G-R Twin G-Fin Section heat exchanger. The unit has wide application for heating and cooling liquids and gases, and for condensing vapors, according to the company. Suitable as boiler feedwater preheaters, fuel oil heaters, etc., features of design and construction are given. Specifications and dimensions are included. Griscom-Russell Co.

263 Heat Exchanger for Process Industries — Bulletin HF-101, 8 pp introduces the Holo-Flight Processor, a new heat exchanger. Tells how it affords control of the flow of material as to duration of treatment, and control of the quantity and temperature of heat exchange agent. Western Precipitation Corp.

264 Heat Exchanger — Bulletin 114, a small folder, gives concise information on company's Aero heat exchanger with balanced wet bulb control designed to cool engines or process equipment, coolants and lubricants, liquids and gases for processing operations. Niagara Blower Co.

265 Air-Cooled Heat Exchangers — Technical Bulletin R-53-DC1 is a 6-pp illustrated article on the economics of the air-cooled heat exchanger for process cooling. Discusses air-cooled exchangers and their selection, gives design details that affect cost and evaluates operating costs. The Marley Co.

FUEL OILS, LUBRICANTS

263 Cooperative Technical Consultation Service — This informative 24-pp booklet presents company's periodic

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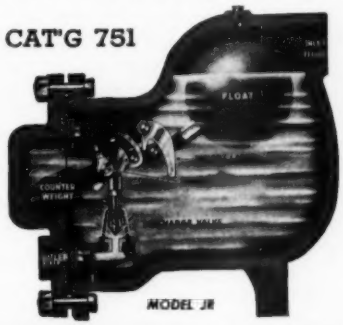

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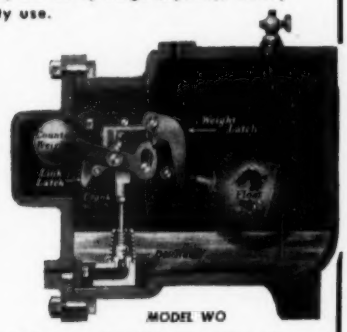
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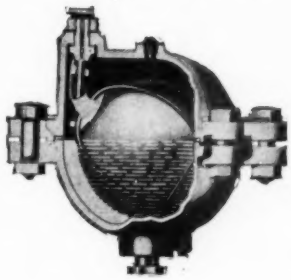

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268 Lubrication of Diesel Engines — An excellent instruction manual, 50-pp Technical Bulletin B-1 (revised) also provides a brief history on diesel engines, an explanation of the fundamentals of design and the common types of diesels and their advantages. Explains combustion process, discusses modern fuel injection systems. Cylinder and bearing lubrication are treated and recommendations given for lubricating oils. Sun Oil Co.

269 Diesels, Their Fuels and Lubricants — This 46-pp book gives practical information on diesel engines, covering their history and economics as well as design characteristics and operating principles. Classification of diesels according to their speed is also explained. Sinclair Refining Co.

270 Versatile Industrial Oil — Described in 20-pp Form AD 4078 is an all-purpose oil offering protection for a wide range of industrial equipment, and available in 15 viscosity grades. Discusses six major characteristics of the oil; explains and pictures its use in hydraulic systems, speed reducers, air compressors, electric motors, hydraulic turbines, bearing systems, etc. A chart shows grades available, their uses and physical properties. Standard Oil Co. (Ind.)

271 Turbine Lubrication — The special problems of turbine lubrication are discussed in 8-pp Bulletin TU-1. Tells how purifiers keep power units in service; discusses inhibited and uninhibited oils, company's process for reducing sludge formation within lubrication system. Illustrated with diagrams of typical installations, photos of purifiers. DeLaval Separator Co.

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272 Turbine Oil Conditioning — Bulletin 832-P, 12 pp, offers a detailed explanation of the reasons for turbine oil conditioning, the way in which company's dry type conditioning equipment nullifies or prevents factors which promote deterioration of oil. Bowser, Inc.

GAS AND OIL BURNERS

273 Gas Burners — Illustrated Bulletin 410-8, 16 pp, furnishes descriptive and technical data on company's gas burners and combination gas and oil burners, giving design details and explaining operation of each. Coppus Engineering Corp.

274 Oil Burning Equipment —Bulletin O-B 37 contains 16 pp of technical information on company's oil and gas burning equipment, steam atomizing burners, mechanical atomizing burners, interchangeable burners, telling best applications, including capacity data. Also shows fuel oil pumping, heating systems. The Engineer Co.

275 Steam Atomizing Oil Burners — Sixteen-pp illustrated Bulletin 21 describes steam atomizing oil burners and auxiliary equipment for use with heavy oil or tar in boilers, stills, dryers and other furnaces, where steam or compressed air is available for atomizing the oil. National Airoil Burner Co., Inc.

REFRACTORIES, INSULATION

276 Industrial Insulations — Just released, this 20-pp catalog describes insulating materials covering the temperature range from —150 to 1800 F, and including cement, block, blanket, felt and pipe covering. Complete with thermal-conductivity graphs and heat loss charts, catalog also shows list prices. Brief application descriptions included, also typical uses, sizes, densities. Baldwin-Hill Co.

277 Refractory Cements — Sixteen-pp Form 863, presenting a line of refrac-

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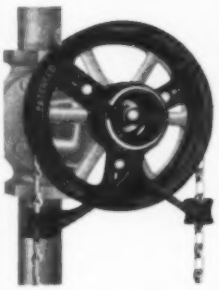

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tory cements, discusses the three basic materials used in them, provides a detailed selection guide and illustrated discussion on methods of preparation and installation. Also defines terminology. Norton Co.

278 Heat Insulation Data — This is a 12-pp illustrated engineering and specification manual describing applications for 85 per cent Magnesia heat insulation. Provides data on heat savings per pipe thickness, for heat ranges to 600 F. Includes charts for determining thickness standards for pipe covering, with tables for heat calculations. Mundet Cork Corp.

COAL, ASH HANDLING

279 Where Refuse Is Fuel — Presented in 24-pp Bulletin are installations of company's stokers with medium-size and larger units burning refuse fuels, separately or in combination with coal. Lists many of the refuse fuels handled successfully by this type of spreader stoker. Detroit Stoker Co.

280 Economic Coal Storage — How tractors establish safe, orderly coal handling is told in this 8-pp booklet. Stresses flexibility, low operating costs. Also shows how tractors speed storage reclamation and how a tractor-scraper combination offers plus benefits. Illustrated with action photos; picture several models. Tractor Div., Allis-Chalmers Mfg. Co.

281 Spreader Stoker Data — This is a file of three illustrated bulletins on spreader stokers. The first discusses seven reasons for selecting these stokers and describes their design, construction and operation; the second, dumping grates, the third, installations. Riley Stoker Corp.

282 Spreader Stoker Selection — Fourteen-pp Form F-520-A10M is intended to help those choosing a spreader stoker to get the most for their investment, and it points out many factors to be considered. American Engineering Co.

283 Shredder Ring Crusher — A crusher for coal and similar materials which features rolling shredder rings is described in this 8-pp bulletin. Gives details on a survey of 29 mines and power plants in which this type crusher is installed. Informative tables giving speed, capacity, horsepower, weight and dimensions of crushers, as well as cost data are included. American Pulverizer Co.

284 Automatic Coal Scale — Sixteen-pp Bulletin 0352 introduces a new automatic coal scale for weighing coal as it is fed to boilers, enabling a power engineer to maintain a constant check on boiler efficiency. Book gives construction and operating details on the belt feeder, weigh hopper, scale housing, operating levers and accessories. Photos and line drawings show scale features. Richardson Scale Co.

WATER CONDITIONING

285 Water Conditioning Data Book — Recently revised, this pocket-size 116-pp booklet presents a compilation of 77 tables, all valuable to the power engineer. Covers such subjects as hydraulics, impurities in water, boiler feedwater makeup requirements, chemical conversions and chemical reactions. Contains excellent reference information on many phases and methods of water treatment. Available without charge to qualified power engineers. The Permutit Co.

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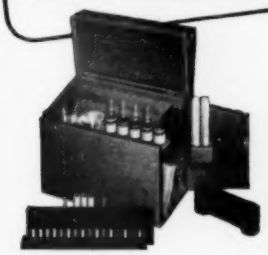

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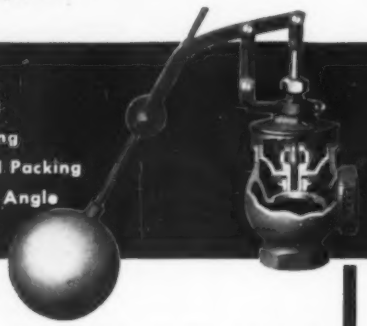

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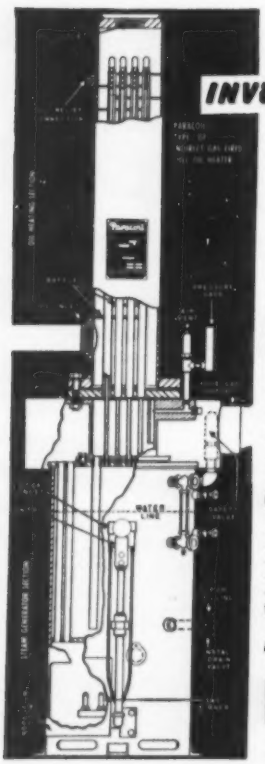

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286 What's What on Ion Exchangers — Here are three booklets on ion exchangers: Nalcite HCR, a styrene type cation exchanger; Nalcite SAR, a strongly basic anion exchanger; and Super Nelcolite, a synthetic gel type zeolite for cation exchange. Tables and graphs explain performance of these water treating resins under various operating conditions. Physical characteristics, exchange capacities, regeneration techniques discussed. Bulletin 57, 20 pp, is on Nalcite SAR; Bulletin 58, 28 pp, Nalcite HCR; Bulletin 59, 8 pp, Super Nalcolite. State those wanted. National Aluminate Corp.

287 Modern pH and Chlorine Control — This 100-pp booklet gives details in color comparators and equipment in water testing and control of boiler and industrial process water, also technical information on meaning of pH control, electrometric and colorimetric methods of determining pH and impurities in water; applications of water control in air conditioning; treating boiler feedwater. W. A. Taylor & Co.

288 Steam System Treatment — This bulletin on Coravol for prevention of corrosion, explains theory of corrosion, application of organic amines to steam systems (the Coravol process) and presents case histories of use in different types of plants and industries. Coravol is part of a complete technical service providing special chemical formulas for treatment of water, steam, brine, fuel. Western Chemical Co.

289 Corrosion Treatment — "Corrosion Protection of Steam and Condensate Return Systems" is a folder on amine treatment for boiler and condensate systems. This treatment is described as affording surface protection of the metal as well as raising pH value of condensate. The Bird-Archer Co.

290 Boiler Scale — Formation and Prevention — Technical Paper 98 is a 12-pp article covering the cause and prevention of boiler scale. Covers the mechanism of scale formation, effect of boiler scale, chemistry of scale formation, internal chemical treatment and chemical correctives. Diagrams of feeder systems, photos and solubility charts illustrate text. W. H. & L. D. Betz.

291 Boiler Water Manual — Factual information on methods of applying chemicals in treatment of water for boilers is presented in 16-pp Standard Method 122. Discusses pretreatment of raw water, application of chemical feeding to pretreating operations and both constant rate and flow responsive feeding direct to boiler drum and feedwater system, condensate returns. % Proportioneers, Inc. %

292 New Data on Zeolite Softeners — Publication 4520-A is a recently revised edition of company's booklet on zeolite water softening. Provides a glossary of terms used in the process, data for laying out a zeolite softening plant, factors governing size of equipment, selection of zeolite materials and discussion of the four stages of operation of a sodium zeolite softener. Cochrane Corp.

293 Water Treatment — Bulletin 5000, 24 pp, explains the reasons for boiler water treatment and tells services offered by company in providing formulations for individual plant requirements. Covers pre-treatment, internal treatment, treatment application, blow-down adjustment,

test control. Describes equipment. Dearborn Chemical Co.

294 Feedwater Treatment — Here is a 10-pp illustrated report on boiler feedwater treatment for a high-pressure, high-makeup power and steam producing plant. It is based on studies to determine best method of meeting requirements for both the high-pressure steam used in power generating turbines and the district heating steam for downtown Philadelphia. Graver Water Conditioning Co.

295 Microbiological Control — Technical Article 3C, 12 pp, is an illustrated discussion of microbiological control of and through industrial waters. A section on industrial water chlorination covers cooling waters and process waters. Other sections deal with chlorine metering in chemical processes, and the sanitary aspects of industrial water treatment. Wallace & Tiernan.

296 Treatment by Ion Exchange — Methods of ion exchange treatment and its general and special applications for water and other liquids are explained in 8-pp Bulletin A. Discusses manufacturers' deionizing equipment as to construction and operation, pictures applications. Illinois Water Treatment Co.

OTHER EQUIPMENT

297 The ABC of CO_2 — An interesting text covering role of carbon dioxide in combustion efficiency, 16-pp illustrated Bulletin 452 discusses theoretical vs practical perfection of combustion and tells how to determine percentage of CO_2 in flue gases, CO_2 as a basis for figuring heat and fuel losses is also described and method of determining such losses explained. The Hays Corp.

298 Turbine Generators — Bulletin H-18, 40 pp, covers turbine generators of 500 kw and above, pictures nearly 50 turbine-generator installations, both utility and industrial. Brief discussions of generator and exciter cooling methods are included. A reference section offers detailed drawings showing a typical installation arrangement. Elliott Co.

299 Mechanical Draft Fans — Mechanical draft fans for both forced and induced draft service are described in 20-pp Bulletin 168. Illustrated with drawings of typical fan types and photos of installations, includes performance curves showing efficiencies of various types of fans. The Green Fuel Economizer Co., Inc.

300 Dowtherm Vaporizer — Bulletin No. 48-2, describing manufacturer's Type "A" Dowtherm Vaporizer, tells how this unit is designed to evaporate Dowtherm to provide dependable operation at maximum temperatures. The Wickes Boiler Co.

301 Ejector Instruction Manual — Bulletin J-50-7 is a 36-pp handbook covering operation, selection, installation and maintenance of steam jet air ejectors. Discusses twin and triple element ejectors, surface and jet inter- and after-condensers, isolating valves, drain traps, steam and back pressures, steam nozzles. Foster Wheeler Corp.

302 Air Preheaters — Illustrated Bulletin A-11610, 8 pp, defines air preheat

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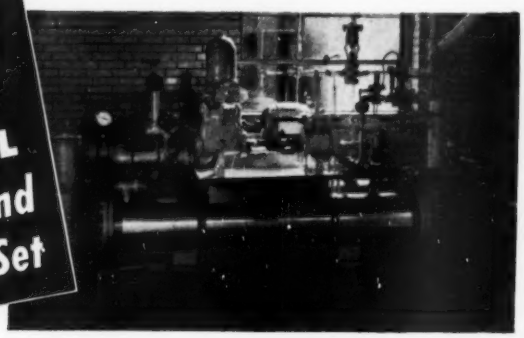

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and explains its benefits in terms of increased efficiency and capacity and flame stability. Provides general description of company's Ljungstrom preheater. The Air Preheater Corp.

303 Motorized Chimney Draft — The advantages of mechanical draft in supplying positive, uniform, adequate draft, regardless of variable weather conditions or inadequate chimney or breeching construction are shown in detail in Bulletin I-52. Also discusses other advantages, including eliminating need for tall stacks. L. J. Wing Mfg. Co.

304 Equipment For Buildings and Institutions — Bulletin WP-1099-B27M is a 20-pp revised booklet of condensed information on sizes, dimensions, capacities, ratings and features, of a wide range of equipment. Covers air conditioning and refrigeration products, with auxiliaries; oil, gas and dual fuel engines, deaerators and deaerating heaters; water conditionings; steam turbines and turbine generators; liquid meters; centrifugal and other pumps. Worthington Corp.

305 Why Fully Crowned Teeth — Seven major engineering advantages of fully crowned teeth in gear type flexible couplings, are described in Bulletin 1052. Applications of Amerigear couplings for the solution of power transmission problems such as excessive offset or angular misalignment and space limitations described. American Flexible Coupling Co.

306 Maintenance Manual — "Over the Rough Spots" is a 48-pp pocket size booklet giving the answer to practically every repair or building maintenance problem. Tells how to patch holes and resurface floors, prevent water seepage in underground foundations, repair leaky roofs, preserve concrete or wood surfaces, protect structural steel from rusting, and gives many time saving methods in solving maintenance problems. Stonhard Co.

307 Water Heaters — Illustrated 6-pp Bulletin 70, Section I, on instantaneous type water heaters contains detailed capacity and dimension tables for two-, four- and six-pass designs, removable tube bundles. Davis Engineering Corp.

308 Soot Blowers on the Job — Bulletin 1004, 32 pp, discusses 15 central station installations of Vulcan automatic-sequential soot blower systems. Power and reheat boilers with capacities to 1,370,000 lb per hour, pressures to 1925 psi and temperatures to 1055 F are included. Copes-Vulcan Div., Continental Foundry & Machine Co.

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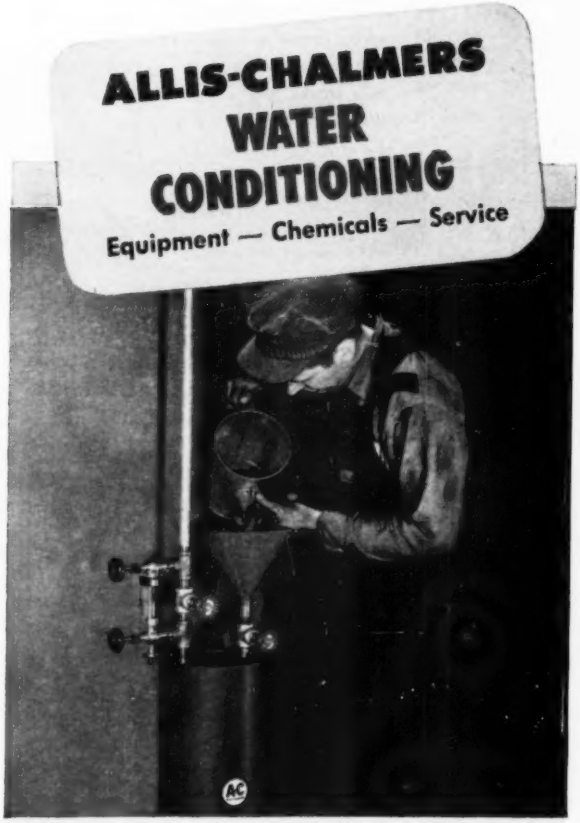

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ATLAS

DAMPER REGULATORS

- *Sensitive*
- *Hydraulic*
- *Automatic*

Bulletin 4-A gives complete data concerning all ATLAS Damper Regulators. Ask for a copy.

If you need a Damper Regulator for this service	Specify
Low Pressure Heating Boilers	No. 501
Low Pressure and Vapor Heating Boilers	No. 501-8
Medium Pressure Power Boilers	No. 502
High Pressure Power Boilers	No. 503

For instance, our "Medium Pressure" Regulator No. 502 is pictured above. It is suitable for boiler pressures up to 150 lb. per sq. in. As shown, it is equipped with a compensating attachment that is simple and mechanically correct, permitting the regulator to gradually move the damper on boiler pressure changes of a fraction of a pound. It holds the damper stationary in a partly open position where there is no change in boiler pressure.

The pilot valves are so designed that the slightest change in boiler pressure is sufficient to open or close them, thus causing the regulator to move the damper in either direction, keeping the boiler pressure within the desired close range. It is so sensitive that the damper is moved on boiler pressure changes of ¼ pound.

See list of other ATLAS products below.

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE

293 South St. **Newark 5, N. J.**

Represented in Principal Cities

Campbell Boiler Feed Regulator
Temperature Regulators
Reducing Valves
Exhaust Control System
Pressure Regulators
Pump Governors
Damper Regulators
Back Pressure Valves
Balanced Valves
Control Valves
Float Valves

For more data circle 589 on Post Card

WHICH OF THIS WHITLOCK EQUIPMENT DO YOU NEED?

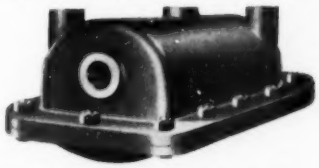
Here's WHITLOCK power plant equipment that's dependable, efficient, and long lived!

Feedwater Heaters

High pressure extraction heaters for large power plants or central stations, and atmospheric exhaust heaters for use with all steam actuated prime movers. These feedwater heaters are Whitlock engineered to meet your exact requirements.

Deaerating Feedwater Heating System

A complete "packaged" unit—compact and simple. It dependably regulates the oxygen concentration to a maximum of 0.03 ml./liter and variations in the deaeration are easily obtained with a simple adjustment of a temperature regulator. Standard sizes available for boilers from 50 to 2000 H.P.



Sampling Water Cooler

Makes boiler water sampling easy for the determination of pH values and salt concentrations. Small and compact—only 8½" x 13". Copper tube and stainless steel tube designs available for elevated operating pressures. Cast iron shell furnished for cooling water service.

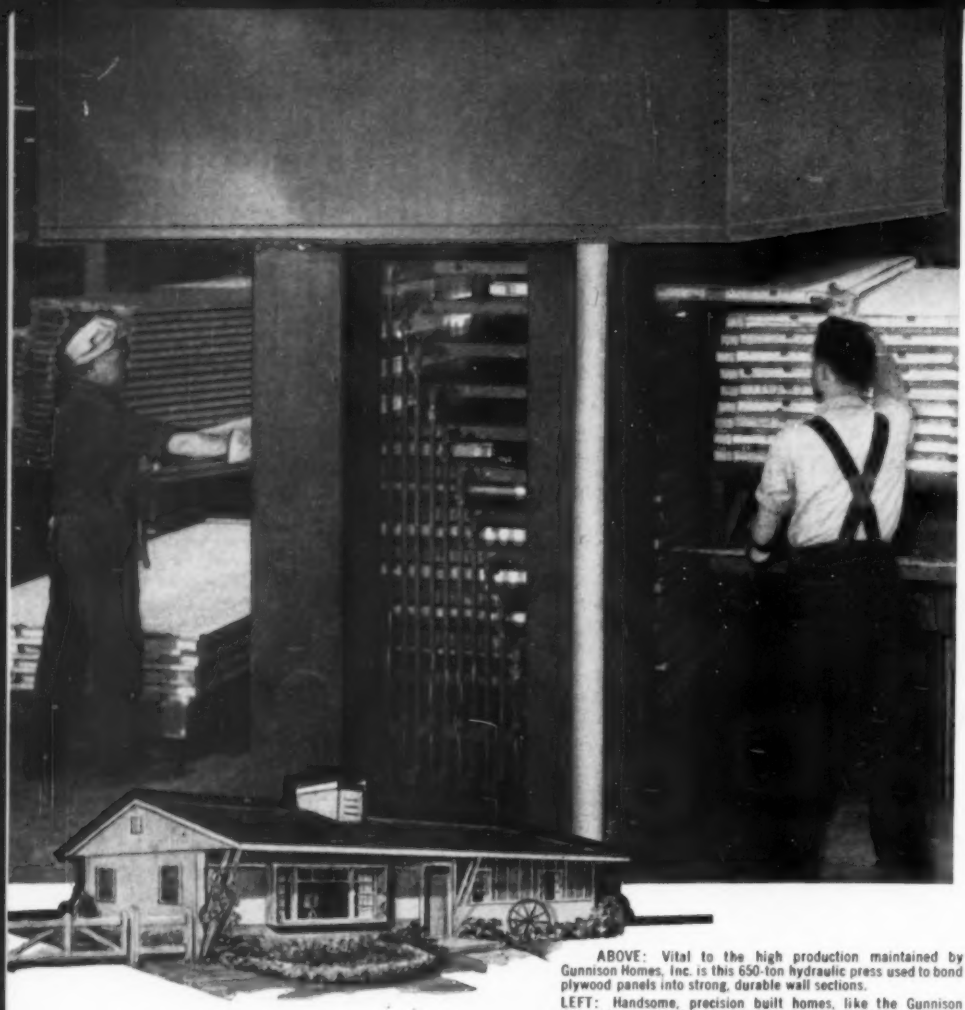
Write for information

The Whitlock Manufacturing Co.
47 South Street, Hartford 10, Connecticut

New York Boston Chicago
Philadelphia Detroit Richmond

WHITLOCK BEST TUNED EQUIPMENT

For more data circle 590 on Post Card



ABOVE: Vital to the high production maintained by Gunnison Homes, Inc. is this 650-ton hydraulic press used to bond plywood panels into strong, durable wall sections.

LEFT: Handsome, precision built homes, like the Gunnison Coronado pictured here, are built in a matter of hours.

Answers a pressing need for Gunnison Homes, Inc. . . .

● Gunnison Homes, Inc., situated in New Albany, Indiana, is one of the leaders in the field of manufactured homes. Key to continuous production of precision built homes at the New Albany plant is the 650-ton hydraulic press, shown above, which was installed in 1947. This press processes ten plywood panels every cycle by the combination of heat and pressure . . . a tough job and one requiring reliable hydraulic performance to maintain production schedules.

STANOIL Industrial Oil was installed in the press when it was put into operation six years ago. STANOIL has stood the test of severe operation . . . with no evidence of oil deterioration being found during a recent inspection of the hydraulic system. Operation has been efficient. Minimum make-up oil has been needed to maintain the oil capacity of 450 gallons.

STANOIL
TRADE MARK
Industrial Oil

Find how STANOIL can benefit you by discussing this multi-purpose oil with a Standard lubrication specialist. You can contact him by phoning your local Standard Oil office. Or, write: Standard Oil Company, 910 S. Michigan Ave., Chicago 80, Ill.

What's YOUR problem?

Ralph E. Murnahan, of Standard Oil's Evansville office, is the lubrication specialist who keeps in constant contact with Gunnison Homes to make certain that there is no interruption of operation due to lubrication difficulties.

He is one of many lubrication specialists who make their headquarters in Standard's offices throughout the Midwest. These men have been specially trained in Standard's Lubrication Engineering Schools and, in addition, have a wealth of on-the-job experience.

To obtain the service of the lubrication specialist in your area, you need only call your local Standard Oil office. The lubrication specialist will discuss your lubrication problems with you . . . at no obligation to you, of course. He has a complete line of petroleum products to offer you, including:

SUPERLA Greases—Available in a wide range of consistency grades and in both lime-soap and soda-soap types. SUPERLA Greases cover a wide range of operations. These efficient products are comparable in quality with the highest type of special greases.

STANOLITH Greases—Because these unique lithium soap products possess the heat resistant properties of soda-soap greases and the water resistant properties of lime-soap greases, they offer a solution to lubrication problems caused by the presence of both heat and water.

STANDARD OIL COMPANY STANDARD *(Indiana)*

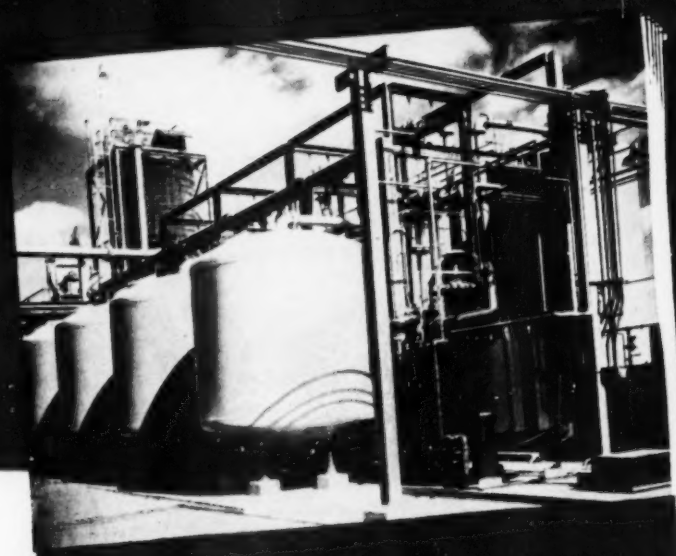
For more data circle 591 on Post Card

For high-pressure, high-temperature service (as well as sub-zero duty), Chapman makes steel valves in a range of series from 150 to 2500 lb . . . in gate, globe, angle and check types . . . in steels of many different analyses and with suitable trim to resist corrosion and erosion.

Chapman Steel Valves are accurately machined and finished, designed to ASA and API ratings, and may be furnished with flanged or welding ends. These valves can be equipped for any type of operation . . . hand, gearing, hydraulic cylinder or Chapman motor unit as shown in illustration. So for all standard and any special Steel Valves, check with Chapman *first*. Meanwhile, write for Catalog 20.

THE CHAPMAN VALVE MANUFACTURING COMPANY
INDIAN ORCHARD, MASSACHUSETTS

For more data circle 592 on Post Card



DEMINERALIZATION
including SILICA REMOVAL
by **PERMUTIT**
ION EXCHANGE

GET THE FACTS

. . . about Permutit Demineralizers for Purer Make-up . . . Lower Cost

You'll want this interesting booklet! Flow diagrams, illustrations and specifications explain key methods of demineralization and silica removal by Permutit ion exchangers and equipment. Write for your free copy —today!

HIGHEST PURITY MAKE-UP Effluents of Permutit Demineralizers have contained *total* electrolytes as low as 0.01 ppm, and silica as low as 0.01 ppm. Under service conditions, values may be slightly higher. In comparison, most distilled water contains 20 to 100 times more electrolytes . . . yet costs much more to produce.

REDUCES B.T.U. COST PER KW-HR The chemical cost for demineralization is usually less than the fuel cost for evaporation of boiler feed make-up. The installed equipment cost for demineralization is also usually less than for evaporation.

ELIMINATES CONDENSATE SHORTAGES A demineralizer is operated independently of the turbine. It may be operated at full capacity if required, even though the turbine is running light and some boilers are standing by idle. It is possible to start boilers of a new plant with demineralized water. The demineralizing system can be placed in operation ahead of the boilers and highest purity make-up prepared for initial starting.

ION EXCHANGERS MEET ALL REQUIREMENTS Choice of units and layout of demineralization and silica removal equipment depend on composition of the water, flow rates, end-use requirements. Permutit makes all types of ion exchange resins and equipment . . . can save you time and money in the specification of the one combination that best fills your needs.

PERMUTIT®

ION EXCHANGE AND WATER CONDITIONING HEADQUARTERS FOR OVER FORTY YEARS

THE PERMUTIT COMPANY, DEPT. PE-5
330 West 42nd Street, New York 36, N.Y.

Please send my copy of "Demineralization including Silica Removal by Permutit Ion Exchangers."

NAME _____ TITLE _____

FIRM _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

In Canada: Permutit Company of Canada Ltd.
6975 Jeanne Mance Street, Montreal